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VOLUME 6, No. 7 **JULY 1954**

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WORLD CROPS

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Vol. 6. No. 7

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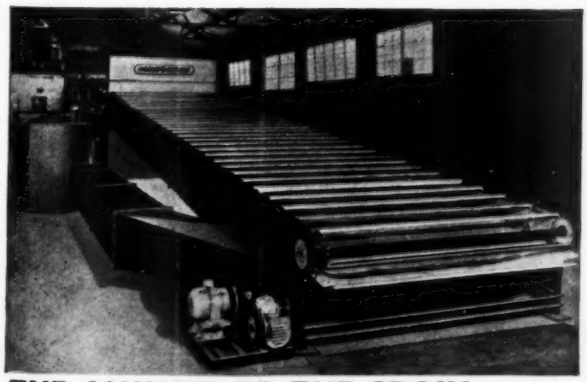

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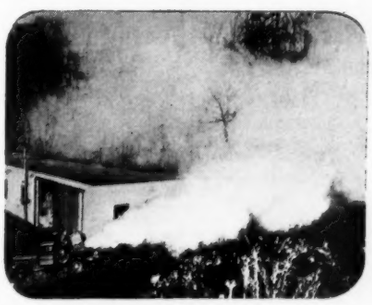

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Editorial Comment

H.M. the Queen

WE join with all sections of the British public in tendering to Her Majesty and to H.R.H. the Duke of Edinburgh our respectful welcome and congratulations on the successful accomplishment of the recent Royal Tour of many dominions and dependencies of the British Commonwealth. We feel that the visit of Her Majesty has been an inspiration to the countless thousands with whom she was brought into contact, while the unique knowledge and experience which Her Majesty has been able to acquire of so large a part of the Commonwealth must prove an invaluable asset both to herself and to her people in the years to come.

Tropical Crop Research Institutes

THE news that the Coconut Research Institute of Ceylon has recently celebrated the 25th anniversary of its foundation prompts us to comment on the manner in which the number of research institutions devoted to research on agriculture in the tropics has increased of late years.

There have been two separate and to some extent opposed tendencies observable in this connection. In one case the object has been to set up research organisations either separately or as branches of the official Departments of Agriculture which embrace all types of agricultural research. In the other the aim has been to establish organisations intended to investigate the problems of a single crop. In earlier days the first type predominated but later it was found that the problems of individual crops were so numerous and so clamant that a strong demand arose for separate organisations to deal with them. Often the demand came from the large plantation industries which expressed willingness to submit to special taxation to provide finance for research.

In consequence, those industries which included a large number of estate plantations could dispose of ample funds and possessed the means of bringing their views forcibly to official notice, succeeded in establishing crop research stations, earlier than those which were mainly made up of large numbers of small holders and were less favourably placed to achieve the establishment of separate organisations for research.

Examples of the former class are the tea, rubber and sugar industries which have established large and highly efficient organisations for research in many countries in which these crops are grown as a plantation enterprise. Some predominantly peasant agricultural industries have, however, of late years also achieved the formation of efficient research institutes, largely as the result of government or quasi government intervention. Of these the coconut industry of Ceylon can claim pride of place as being among the first in the world to establish an agricultural research institute for an industry which is predominantly composed of small holders. Since then, of course, the number of research institutes of this type has considerably increased; examples are the Cocoa Research Institute in the Gold Coast, the Rice Research Institute in Sierra Leone, the Rice Breeding Station at Cuttack in India, the Oil Palm Research Station at Benin in Nigeria and the Research Organisation of the Indian Central Coconut Committee.

In Ceylon the Coconut Research Institute is now firmly established and, we are informed, has recently taken steps to increase the resources available to it for the prosecution of research. The value of its work for the industry is widely recognised; one of the objects which it has attacked of late years is the rehabilitation and rejuvenation of the large areas under coconuts in Ceylon which have passed their prime and are now deteriorating as the result of increasing senescence. If this object is achieved the debt which the industry owes to the Institute will be greatly increased.

We take the opportunity of congratulating the Institute on attaining its silver jubilee coupled with the hope that many years of ever-expanding utility and activity lie before it.

An abnormal spring

A FEW months ago (see WORLD CROPS, **6,** 89, 1954), we referred to a press conference organised by the British fertiliser industry and held to draw attention to the physical difficulties of the huge spring peak demand for fertilisers. Impressive evidence of the magnitude of this annual problem of tonnage movement was given, and if on that occasion any visitor had got up and said ' Don't worry, it may never happen,' he would have been regarded as a somewhat unhelpful humorist. Yet, as events have turned out in 1954, he would have been a remarkably well justified prophet. For the first time for many years the fertiliser season has proceeded smoothly without a typical peak. This could have been caused, of course, by badly diminished demand, but that is not the explanation. Most reports indicate that the tonnage of fertilisers used has not been less than last year, and has probably shown a small improvement. It was the weather that confounded all experience and expectation. March, usually the month of active and ever-accelerating demand, was abnormally wet and cold and very little of the spring sowing programme could be started. Presumably many farmers with fertiliser deliveries booked for March and did not postpone these arrangements.

March was therefore an active month for the industry but pleasantly free from the pressures of urgency. When at last sowing and planting could go forward in April, a large proportion of farms were well stocked, so that even a month of peak activity on the farms themselves was still a period without ' rush-hour ' conditions for the industry. These steadily active conditions continued into May, and it is doubtful whether anyone in the fertiliser industry can recall a spring in which the daily pressure for deliveries was so steadily balanced against real possibilities of production and distribution.

Man may predict and plan, but the weather—in agriculture—disposes. Nevertheless, the problem of the peak

remains. Abnormality is unlikely to duplicate itself. It is doubtful whether any member of the industry is optimistic enough to expect another ' easy ' spring for many years to come.

Saving the pieces

WE have received a copy of the last report of the Overseas Food Corporation, which has been reconstituted in an effort to rescue all that was rescuable from the wreck of the grandiose East African Groundnut project. The board of the scheme has been reorganised and its headquarters transferred from London to Tanganyika. A former Director of Agriculture in Kenya, Mr. Stuart Gillett, C.M.G., has been appointed chairman of the new board, the personnel of which has been revised to include a high proportion of members with long experience of East African conditions, some of whom were formerly members of the Colonial Agriculture Service.

It is probably not too much to say that the unfortunate experiences of the past were in no small part due to the readiness of those in authority to accept the views of people whose visionary enthusiam and volubility was only exceeded by their ignorance, and failure to be guided by the views of those who knew the actual conditions on the spot. The present reorientation of control is a propitious indication that there is at least a chance that some benefit may ultimately emerge from this colossal failure which has so sorely damaged British prestige.

Actually, the programme which has emerged and which has now been entered upon is essentially one of cautious large scale experiment designed to ascertain what is really possible of accomplishment in a region which is naturally dry, poor and unpromising. The millions of acres which it was originally intended should be brought into cultivation has now been whittled down to a mere 40,000 divided between the three regions originally opened up—Kongwa, Urambo and Nachingwea and divided into a series of farming blocks each under the charge of an experienced farm manager. One may remark that although the scale of these operations has been much reduced they still represent a very considerable enterprise when judged in terms of previous large scale farming operations in the tropics.

The new policy for the groundnut scheme

GONE moreover is the intention to concentrate on the production of a single crop *i.e.* groundnuts, although they are still included in the programme. Experience however indicates that ' Rosette ' disease is an obstacle to groundnut cultivation which has not been surmounted, a point which incidentally was stressed but disregarded when the scheme was first launched. Instead there has been substituted a plan of large scale experiments with a series of crops including in addition to groundnuts, cotton, maize, sorghum, soya beans, fibre crops, fodder crops and tobacco as well as trials with various forms of animal husbandry.

At Kongwa in 1952-53 rainfall was so low that attempts at crop production were a total failure. As the report points out the year was one of low rainfall throughout East Africa, but at Urambo and Nachingwea fair crops were reaped. Previous experience has shown that Kongwa itself is so very liable to drought that one wonders whether it can ever become a region of profitable cropping. It seems at least probable that at best it can only be a marginal region, if agriculture can be profitably undertaken at all there. Prospects at Urambo and Nachingwea are better. At Urambo an attempt is being made to develop an African co-operative tenant scheme, while at Nachingwea interest centres on a European settlement scheme designed to examine the potentialities and economics of farming this land by settlers.

The scientific services, which to the minds of many constituted the one bright spot in the past history of the Corporation's operations, have been reorganised, and are being continued as separate activities at the three centres. The work has included soil studies, economic botanical investigations, fertility studies and pest control research. One wonders whether the decision to subdivide the scientific work in this way is really the soundest policy.

It is heartening, however, to see how the effort is being made to reorientate development along sound and rational lines; all will wish the undertaking well and trust that out of the welter of errors and failure which attended the original scheme, a successful form of development for the lands of this marginal region may eventually emerge.

Fats in feedingstuffs?

THE great modern rise of synthetic detergents has created a new outlet problem for the so-called ' inedible fats,' tallow and grease. It is a problem aggravated by modern improvements in efficiency of recovery, for the production of tallow and grease in the United States is at least double what it was before the war. Before the days of detergents 80% of this output was used for soap making; since 1947, the demand from the soap industry has dropped by about a third and it is still falling. The United States, for long the world's principal producer and exporter, found a partial solution in raising exports to countries where soap manufacture had yet to meet the full challenge of detergents; between 1947 and 1952 exports made a tenfold advance. But even cheap tallow and grease requires dollars, and detergents are now cutting demand down in other countries as well. The battle of the wash-tub that began in America is being waged all over the world today. Basically the problem is an agricultural problem for indirectly the inedible fats are part of the output of every meat-raising farm; the receipts from sales of tallow and grease reduce the costs of meat processing, and without this by-product revenue meat products must be dearer.

The return of these fats to the farms for animal feeding is the only large-scale outlet likely to replace the long-established soap outlet. One pound of fat is worth about 2½ lb. of carbohydrate on calorific valuation. At Cornell University and at the American Meat Institute Foundation tests have shown that about 8% of the cereal carbohydrate

normally fed to cattle can be safely substituted by waste fats. At the University of Nebraska steers fed on tallow-containing feeds cost less for equivalent weight gain than similar steers fed on all-vegetarian carbohydrate, and their appearance was said to be rather glossier. Similar results have been obtained in chicken-feeding trials. If only one ton in every hundred tons of animal feedingstuffs sold contains from 5% to 8% of rendered tallow, the whole of the detergent-caused surplus can be absorbed. One difficulty is that fat develops rancidity in feedingstuffs too quickly, a serious commercial risk for commodities that may have to be stored for several months. However, it can be overcome by the addition of small amounts of chemical stabilisers (anti-oxidants); for example, one year's storage at room temperature without rancidity is possible if traces of butylated hydroxy-anisole are present. An advantage is that the presence of fats in feedingstuffs tends to reduce their dustiness.

There seems little doubt that this new development in America is going to expand. It must have repercussions on the market for corn—every pound of tallow used for animal feeding will displace two or more pounds of corn. Thus, solving one farm surplus problem will aggravate another. Nor, perhaps, should the significance of a less commercial point be missed. It has usually been considered that the meat-yielding animals are herbivores by nature; bringing animal products into their diet explodes this convention. When the housewife uses detergents instead of soap she sets in motion bigger changes than those that occur in the sink or washing machine.

The B.I.F.

DURING May 1954 the British Industries Fair was held on similar lines to those which have characterised these occasions since the war; as usual it was a tripartite organisation with sections at Earls Court and Olympia in London and a heavy industries section at Castle Bromwich at Birmingham. It was a somewhat noteworthy event since this was the last Fair to be held on the lines previously followed, for in 1955 the Fair will be organised under the auspices of the company set up with the title 'The British Industries Fair Ltd.,' in accordance with the recommendations of the Goodale Committee, implemented under the British Industries Fair Bill, which was given its third reading in the House of Commons on March 18 last and was subsequently passed by the House of Lords.

In its passage through Parliament the Bill came in for a certain amount of criticism but it can be said that there was agreement that the Fair had not achieved the full success, nor obtained the support, nor attracted public attention to which it appeared to be entitled. There was criticism that the Fair had in the past been handicapped by rigid government control, while the publicity which it received was held to contrast poorly with that which attended similar trade fairs in continental countries.

It is to be hoped that the new arrangements under which the running of the Fair will pass into the hands of a Board mainly drawn from the business sections of the British community may have the effects of improving matters. This year in fact the Castle Bromwich section was the only one which could be considered to be fully effective and representative. The textile section at Earls Court and the Olympia display were chiefly notable for the absence therefrom of a number of firms who could reasonably have been expected to be represented. Even the Commonwealth section at Earls Court, although it followed the lines of previous years, was noticeably less representative than usual.

A national fair such as the B.I.F. should fill an important role, indeed it is hardly too much to say that if the aim of a greatly expanded British export trade is to be attained, it should be regarded as an almost essential provision. It is to be hoped that under the changed auspices a new era is dawning for the B.I.F. and that in the future, freed from the dead hand of bureaucratic control, a career of enhanced utility lies before it.

Speedier soil testing

IT is natural enough for scientists to discourage demands for haste, for accuracy and speed are usually incompatible. On the other hand, results of soil analysis, if unduly delayed after sampling on farms, have a much lessened practical value. For small areas and for the simpler problems of soil condition the rapid testing outfit technique is useful, but the results obtainable can hardly be regarded as a sound basis for thoroughly reorganising the fertiliser programme of a farm; even the more cumbersome traditional laboratory methods do not always produce the right answers, as a former Director of Soil Surveys for England and Wales, pointed out some ten years ago when he said that soil analysis was a method of prediction with a 70% standard of accuracy. Short cuts in actual methods of analysis must be most cautiously appraised for should they bring greater uncertainty the 70% standard might slip downwards to 60% or even 50%, and any method of estimation that has as low a standard as 50% (*i.e.* the chance of being right is 1 out of 2) is getting indecently close to coin spinning.

The only practical solution is for soil analysis laboratories to reduce the labour chores involved in carrying out the standard tests, and a good deal of progress has been made in this direction at most centres. Analyses of a number of different samples can be conducted simultaneously by the same worker, a form of organised 'mass production' that brings an inappreciable risk of increased error. No doubt the problem, like most problems of agriculture, is complicated by seasonal pressure, with far too many samples queueing for attention at certain times of the year. Spreading the 'load' of demand is a task for those outside the laboratories, for advisers and farmers themselves.

A valuable contribution on the subject of soil analysis labour-saving devices has been made by D. E. Hogg and D. F. Waters of the Rukuhia Soil Research Station, Hamilton, New Zealand. Their recent paper (*N.Z. J. of Science and Technology*, **35**, 5A, 414, 1954), describes seven pieces of apparatus which have been in daily use in the Rukuhia laboratories for a number of years. All of them are 'home-made' and they have enabled the station's output of analyses to be increased four times without expansion of staff. A simple soil measure, a pair of liquid dispensing units for 10 ml. and 400 ml. quantities, a flask

shaker, a tipping and filtering unit for the cumbersome phosphate test, a filter-pump operated apparatus for automatically adjusting solution volumes in flasks, and a rapid constant-volume distilled water dispenser are all described; their construction is claimed to be ' within the reach of any establishment with a glassblower and a small workshop.' This is not the place to attempt potted versions of description, and we are content to draw attention to this stimulating New Zealand paper.

Rain making

A SHORT time ago, in our issue of October 1952 to be exact, we had occasion to comment in these columns on the possibility which had revealed itself in the light of recent work of artificially inducing rain by the employment of methods based upon scientific theory and practice. Since that date practice in this direction has made appreciable advances and the possibility of artificially inducing rains can be said to have come appreciably nearer.

The matter was reviewed in a paper recently delivered before the British Royal Society of Arts by Dr. Irving P. Krick, President of the American Institute of Aerological Research, who at the outset of his paper pointed out that during the last eight years significant progress has been made in the application of cloud seeding to increase natural rainfall.

In many parts of the world increases in population have led to increasing demands for water and at present the world consumption of water appreciably exceeds the amount available through rainfall despite the existence of adequate storage and distribution facilities. Normally nature has difficulty in precipitating as much as 5% of the moisture which exists in the air streams during stormy periods, while during droughts vast amounts of water pass overhead without any precipitation taking place.

At present it is only during natural stormy periods that man can assist nature to extract rain from this almost limitless store of moisture. If by artificial stimulation of precipitation the natural efficiency could be increased from 5% to 10%, the amount of water which reaches the earth's surface could be doubled. This extra water would not be lost to the atmosphere; it must eventually return through evaporation. Consequently, cloud seeding for the induction of additional rainfall does not upset the hydrologic cycle; it merely increases its efficiency from the point of view of man's requirements.

The earliest approach to the problem dates back to the 1890s, when patents were issued both in the U.S.A. and Europe for devices for seeding clouds with dry ice for the production of rain. These early attempts failed by reason of lack of information on conditions in the upper atmosphere. Interest in the subject revived during the first 30 years of the 20th century as a result of increasing knowledge of atmospheric conditions, culminating in large-scale experiments in 1946 and subsequent years at the General Electric laboratories at Schenectady, New York.

Broadly speaking, nature precipitates water from the clouds in two stages, the first being droplet or ice crystal formation and the second the coalescence of ice crystals or drops until they fall through the air stream which carries them. If small particles are injected into clouds, they form nuclei upon which ice crystals or drops can form.

Several substances have been used as ice crystal producers in cloud masses; the most generally used are dry ice and silver iodide. Dry ice operates by cooling the air it comes into contact with to —40°F., at which temperature ice crystals form naturally. Silver iodide, on the other hand, can be vaporised to produce a myriad of tiny ice nuclei which will react to produce ice crystals at temperatures as high as 25°F. In practice, silver iodide has the advantages that it can be dispersed into air streams in effective concentrations over relatively wide areas, and can also be introduced into suitable cloud systems from the ground. Dry ice, on the other hand, can only be introduced into the tops of clouds from aeroplanes or other means, while it quickly evaporates as it falls through the air. For these reasons silver iodide is preferred to dry ice.

Experiments in cloud seeding for the production of rain have been carried out by the organisation directed by Dr. Krick in 18 states of the U.S.A. and six foreign countries during the past six years. These have involved approximately 200,000 hours of cloud seeding operations and have led to increases of from 20% to 70% in natural precipitation in different localities at different seasons of the year. Obviously the method itself has now attained the status of a practicable operation; computations by the United States Department of Agriculture in relation to work of this type in the dry central region of Utah indicate that each additional inch of rain is responsible for the production of 46 lb. per acre of additional herbage, which over one million acres of semi-desert country is worth $460,000.

It seems probable that cloud seeding operations for the production of additional rain will become an accepted procedure in due course throughout the drier regions of the world.

Fertilisers and 2,4-D

MOST of the discussion on mixtures of fertilisers and pesticides has centred on fertiliser-insecticide combinations, but there is a more obvious and logical association between plantfoods and weedkillers. Although there has been some production of turf fertilisers containing MCPA or 2,4-D, surprisingly little other development has taken place. Dr. G. C. Klingman of the North Carolina Experiment Station has recently reported successful tests with corn using 2,4-D esters in ammonium nitrate solutions for post-planting application. This new type of ' combined operation ' has all the merits of simplicity. The esters need not be added to the ammonium nitrate solution until just before use. The amounts added—equivalent to about 2 oz. per acre—give the farmers no formulation problems beyond their reach. A wetting agent should be present to facilitate uniform distribution. If ammonium nitrate (or other nitrogen) solutions are in any case going to be used for top-dressing the crop, the incorporation of weedkiller and its subsequent application is virtually free of labour-cost. It should be said, however, that another season's field research is planned before the practice is ' ripe for recommendation.'

The Cocoa Industry in Nigeria, the British Cameroons and the French Cameroons

Part I—Cocoa Growing in Nigeria

D. H. URQUHART, B.Sc. and G. A. ROSS WOOD, B.Sc.

Cadbury Brothers Ltd.

In the early part of 1954 a visit was paid to the cocoa growing districts of Nigeria, the British Cameroons and the French Cameroons by Messrs. D. H. Urquhart and G. A. Ross Wood on behalf of Cadbury Brothers, Ltd. In this and the succeeding numbers of WORLD CROPS *we shall reproduce the main portions of their report, which gives an assessment of the position of the cocoa industry in each territory. We are indebted to Cadbury Brothers, Ltd., for permission to publish it.*

THE area of Nigeria is some 372,000 sq. miles and the population is upwards of 26 million. The value of external trade in 1951 was £215 million. Imports amounted to over £84 million and exports to over £130 million.

Cocoa in Nigerian economy

It is estimated that there are some 500,000 acres under cocoa and it is by far the most valuable export. In 1951, the value of 121,478 tons of cocoa exported was £36,565,000. This was more than the combined value of the palm kernel and palm oil exports, and £10 million more than the combined value of groundnuts, rubber, cotton and bananas exported in that year.

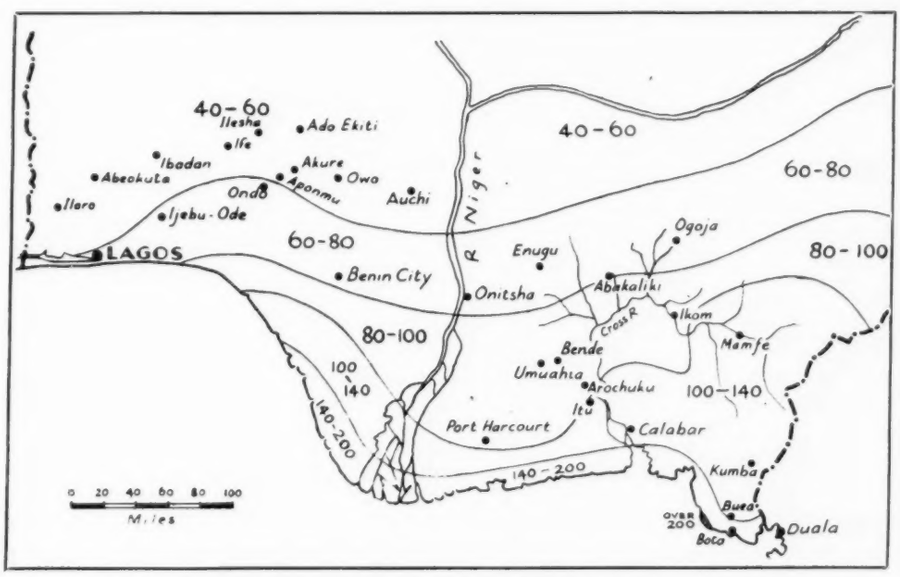
It has often been said that cocoa is the life-blood of the Gold Coast; it may also be said that without cocoa the life-blood of Nigeria would be a somewhat attenuated stream. The value of the cocoa exported in 1951 constituted 30% of the value of all (£126.9 million) domestic exports.

Cocoa is overwhelmingly the most important single factor in Nigeria's economy. It is alarming to contemplate that this valuable asset in the country's wealth is in danger from the killing disease of virus and that, through the devastating effects of capsid bugs which damage the trees and reduce output, and from the effects of a fungus which gives rise to black pod disease and annually destroys a large proportion of the cocoa pods, the country is denied the much greater wealth that could be derived from this crop. The urgency for stepping up and organising research to limit the effects of diseases and pests is evident.

The Western Region has given a good indication of its awareness of the need for action by ordering £100,000 worth of equipment to combat black pod disease. The value of cocoa to Nigeria suggests that its importance would justify the expenditure of several millions, if such expenditure could be directed towards removing some of the dangers which face the cocoa industry at the present time. Some of the experiments conducted by Mr. Gordon Sutherland for the control of capsids are very promising. Progressive steps are being taken for the rehabilitation of areas which have suffered through cocoa disease, and for the development of backward areas. Many thousands of seedlings of cocoa, oil palms and citrus are being raised in Ibadan, Abeokuta, Ondo and elsewhere in Nigeria for issue to farmers. Soil surveys show where cocoa can be replanted and where new planting areas are to be found.

The conclusion forced on the visitor to the main cocoa areas of Nigeria is that nearly all the trees are suffering from severe attacks of disease and that, unless steps are taken to remedy the present situation, it is only a matter of time when cocoa output as a whole will be greatly reduced. Planting of new areas will not provide an increased output indefinitely as the new areas will in due course succumb to the prevalent diseases and pests.

The urgent needs of the cocoa industry in Nigeria are to find the means of controlling swollen shoot, wide application of spraying to reduce losses from black pod, and further experimental work on capsids.



Part of Nigeria, showing annual rainfall in inches

(*Left*) **Cocoa trees heavily attacked by capsids.** (*Centre*) **Strong chupon growing from the base of an old cocoa tree. The old tree will be replaced by the chupon.** (*Right*) **Cocoa pods attacked by helopeltis**

The Inspector General of Agriculture and his senior staff are well aware of these needs.

The Western Region

The bulk of Nigeria's cocoa is grown in this region. Overall production has not changed markedly for a number of years. Decreased production owing to loss of trees killed off by disease or which died from senility or other cause has been offset by production from new areas coming into bearing.

The main producing areas of this region are Ilaro in the south-west, Abeokuta, north and south of Ibadan, which provides a great proportion of the whole output, Ife, Ilesha and Ondo. Production here is fairly concentrated and cocoa farms cover large areas. East of Ondo district, cocoa farms are scattered and distributed over a wide area extending to the River Niger.

Much new planting has taken place in recent years, but there are still available large areas of land suited to cocoa in the southern districts of Ondo Province. Dr. H. Vine estimates that there are areas totalling 200 sq. miles north, west and south of Ilesha (extending to south and east of Ife) well suited to cocoa.

East of the boundaries of Ondo district and south of 7° latitude, extension of planting will be limited by lack of good soils; north of this latitude the limitation will be that much of the territory is subject to the severe drying effect of the harmattan winds. New plantings are being made in these areas and output is increasing, but, as in the past, cocoa planted in unsuitable conditions must have a shorter than normal life.

The Eastern Region

Since the beginning of the century, cocoa has been planted in that part of Nigeria east of the Niger and extending to the borders of the Cameroons, now known as the Eastern Region. Although planting was fairly widespread, the cocoa which has survived is to be found mainly on the banks of the Cross River north of Itu, between Arochuku and Bende, a small amount east of the Port Harcourt-Aba Railway line, and a lesser amount in the Niger delta.

Although planting of cocoa has taken place of recent years, since high prices have ruled, the extension of cocoa growing in these areas will be limited by the amount of land suitable for cocoa and by the fact that most of these areas are densely populated and the land is required for production of local foodstuffs.

Much of the cocoa established in the early years was planted on unsuitable soils and died out 15 to 30 years after planting. It is safe to assume that a considerable proportion of the cocoa planted in recent years has been planted on marginal soils and will have a short life. Many years ago, cocoa was also planted in the district of Ikom in Ogoja Province, and there has been a rapid extension of planting here in the past 20 years. Output has now reached over 180 tons per annum, and in the next few years this figure will be greatly increased.

The prospects for developing the cocoa industry in this area have been under consideration for some time. It was at first thought that a great deal of the land between Obudu in the north and Ikom

Young cocoa growing well under shade of plantains. Department of Agriculplots at Ibadan. Native authority land

in the south would be suitable for planting cocoa. Extensive surveys by R. H. Ball, Agricultural Officer, have shown that land suitable for cocoa is mainly restricted to a triangle having the Ikom-Ajasso Road as its base and a point 9° 5′ east longitude and 6° north latitude as its apex. This covers an area of about 130 sq. miles and, although not all of this is suitable soil and part of it is at present occupied by forest reserve, there are large areas where cocoa could be planted. It is within this area that the Eastern Region Production Development Board is to establish an estate with cocoa.

There are scattered plantings of cocoa in the Ikom district extending north from 6° north as far as Obudu, and again westwards, but most of these are on marginal or sub-marginal soils and will have a limited life. The extension of cocoa planting at Ikom will not be limited for a long time to come by the availability of land, but rather by the shortage of population. The type of cocoa grown resembles that found in the Cameroons, from where no doubt the bulk of it has been derived.

The cocoa trees grow extremely well in the climate of Ikom and do best under shade. Unshaded trees have usually a high proportion of leafless twigs, such as are to be found in the Cameroons where shade is absent. Phytophthora is common and reduces output. Thread blight is fairly common. Cocoa is evacuated from Ikom to Calabar via the Cross River. During the 2½ to 3 months when the river is in flood power-driven craft can come up to Ikom, but for the remainder of the year produce is evacuated by light barges which are man-handled.

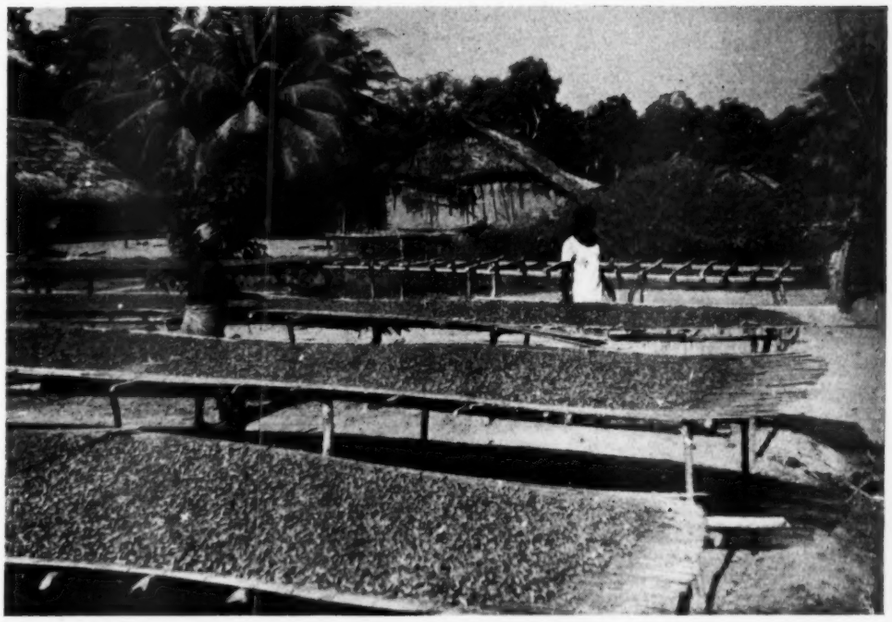
The general conclusion in regard to the Eastern Region is that there will be considerable expansion of cocoa growing in the Ikom district and, with reasonable application of skill in the control of black pod, shading and general attention to the trees, the output here could well exceed 10,000 tons in the near future. Elsewhere the output will probably reach higher levels than in the past, but it is doubtful if these will be maintained for long, as much of the increased output will be derived from cocoa farms which, on account of being on marginal or sub-marginal soils, will die off after a few years.

Soil surveys

The Division of Soil Survey is under the direction of Dr. H. Vine, who is supported by a team of soil scientists and junior staff. Dr. Vine had made an extensive study of Nigerian soils for a number of years and was seconded to the Gold Coast in 1948 to study soil survey methods as practised by Mr. Charter. In March 1951 he began systematic soil surveys of the Western Region of Nigeria and quite remarkable progress has been made to date.

The programme envisages reconnaissance surveys of the cocoa belt, section by section, a total area of some 18,000 sq. miles in the Western Region, and semi-detailed surveys of special areas varying from a few sq. miles to 50 sq. miles in extent. By April 1952 the field work of the reconnaissance soil survey of approximately 750 sq. miles of the south-eastern part of Ibadan Province was completed and a semi-detailed soil survey of the Ijebu-Ode Plantations Project (21 sq. miles) of the Western Region Production Development Board had been made. Maps and other essential information about the soils are being provided. Operations have now been extended to Ondo Province.

Apart from providing information which indicates suitable areas for extension of cocoa planting, the soil surveys are invaluable in showing where rehabilitation of devastated areas is worth while. Even where small areas of cocoa have been cut out to control swollen shoot, the Soil Survey Division will survey the area to decide whether replanting is advisable.



Cocoa beans being dried on trays. Near Benin

Diseases and pests

Virus disease of cocoa—Swollen Shoot

The present position of swollen shoot disease in Nigeria was reviewed at the Cocoa Conference in London in September 1953 by Mr. R. B. Allnutt. Some of the important points brought out by Mr. Allnutt are that the preliminary survey showed that the disease was confined to Ibadan district and that isolated outbreaks were discovered at Ilesha and in Abeokuta Province. Subsequent detailed surveys indicated that the virus had reached epidemic proportions around the main centres of infection. The method of cutting out was adopted for the control of the main areas of infection in February 1946 but this policy was abandoned in June 1950 in favour of a ' cordon sanitaire ' in the hope of isolating the areas of mass infection from the healthy areas.

Staff was organised to inspect the cocoa within the cordon sanitaire at six-monthly intervals and for treatment and retreatment of centres of infection at three-monthly intervals. Seventeen centres of infection were discovered up to February 1952 and from that date until February 1953, 25 new centres of infection were found. A second survey in the Ilaro division of Abeokuta Province has revealed scattered infections over an area of 36 sq. miles with an aggregate area of cocoa of some 8,000 acres.

In discussing the present position, Mr. Allnutt goes on to say, ' Above all, the picture discloses the lack of knowledge regarding the behaviour of the virus and the need for more information,' and later on says, ' . . . much more knowledge regarding the virus itself and its behaviour is required before a more effective policy can be framed. The immediate need is the survey of the present position by a research team working in close association

with the West African Cocoa Research Institute.' Again, Mr. Allnutt says, 'The discovery of the Ilaro outbreak and experience gained in the cordon sanitaire indicate that more frequent and intensive surveys are an urgent necessity if a true picture of the position is to be obtained, and all foci of infection are to be found and treated in a timely manner to prevent a build-up into a major outbreak. For this purpose a considerable increase in the staff of the Cocoa Division will be required. Representation is being made to the appropriate authorities for additional funds.'

Mr. Allnutt's review indicates that virus disease constitutes a serious threat to important cocoa-producing areas of the Western Region. The urgency for increasing the staff to deal with the present situation, the necessity for comprehensive detailed surveys and for an intensive study of the strains of virus cannot be overstressed.

The present senior staff consists of seven permanent and nine temporary cocoa survey officers with junior staff. There is no doubt that this staff will have to be greatly increased in order to be able to deal with the present critical situation. In order to provide for research, a sub-station of W.A.C.R.I. is being established at Ibadan with a staff of two entomologists, two virologists and one biochemist. One of the entomologists will be concerned with the study of mealybugs and the other entomologist with that of capsids.

Phytophthora fungus disease—

Black Pod

This disease is present to a greater or less degree in all parts of the world where cocoa is grown. In the wetter parts of Nigeria the incidence of disease is high. The proportion of cocoa pods which are destroyed or rendered useless owing to this fungus is up to 60% in parts of Ondo Province. The extent to which the disease limits the annual output cannot be estimated, but it is safe to say that, if even partial control of this disease could be effected, the output from Nigeria would be increased by many thousands of tons.

At the 1953 Cocoa Conference, Mr. Thorold described the large-scale experiments to control black pod at Aponmu, in Ondo Province. These experiments have given spectacularly successful results and suggest that the method of spraying the pods with 1% carbide Bordeaux mixture is both effective and economic. The results have given great confidence to local cocoa farmers. The Western Region Production Development Board and the Co-operative Bank have each provided £50,000 for the purchase of spraying equipment consisting of 2,000 hand-operated spray pumps, 400 tons of copper sulphate and 200 tons of calcium carbide.

Baskets in which small quantities of cocoa are fermented. Near Benin

The intention is that this equipment will be used to provide the cocoa farmers with a spraying service which will protect their crops from the fungus. It is sometimes overlooked that spraying for black pod control has been standard practice for a number of years in the Spanish-owned island of Fernando Po. This small island produces 15,000 tons of raw cocoa annually.

Capsids

The attacks of these bugs have a devastating effect on young and old cocoa trees in the Western Region, although young seedlings suffer less damage here than they do in the Gold Coast.

The recurring attacks of this pest on the young shoots retard the growth of young trees, reduce the yielding capacity of mature trees and induce premature senility in trees subject to severe attack. The pest is widespread in the main cocoa areas of the western region, but in the eastern region it is not of economic importance. It is impossible to make an accurate estimate of the loss in output sustained annually owing to the attacks of capsids, but it runs into many thousands of tons and capsids rank with virus as a major menace to the cocoa trees.

Experiments for the control of capsids, conducted by Mr. Gordon Sutherland at the Ibadan Native Administration plots, are very promising and hold out high hopes that it may be possible to control the pest on a large scale. His best results were obtained by dusting with DDT 5% and with BHC 0.45%. With the use of a Berchmier 'Mistral' dusting machine powered with a 50-cc. engine he was able to dust just under 1 acre in 15 minutes.

Organised planting

The Western Region Production Development Board are developing an estate

Cocoa plants raised from rooted cuttings of selected material. Moor plantation, Ibadan

in the region of Ijebu-Ode, at Apoje, where several hundred acres of cocoa are to be planted in addition to oil palms, citrus and rubber. The Agricultural Co-operative Society in Ondo is establishing areas of cocoa and oil palms in land previously in high forest. The Production Development Board contemplates establishing a cocoa plantation in the eastern part of Ondo Division. The Eastern Region Production Development Board has selected a site east of Ikom where several hundred acres of cocoa are to be planted.

In each case the soils have been carefully examined and selected for their suitability for the crop. In the case of the estate at Ijebu-Ode, the land has been surveyed and mapped by the soil scientists, and the different plantation crops are being grown on the soils most suited to them. The enlightened methods of husbandry practiced on these plantations will, in due course, serve as a useful demonstration which it is hoped will have a far-reaching effect on local practice in cocoa farms.

The need for research and experimental work

Nigeria could produce many more thousands of tons of cocoa from the land already under this crop if losses through black pod and capsids could be brought under general control. The annual losses of crop through black pod, and the extent to which yields are depressed through capsid damage, represents millions of pounds every year. The cumulative losses to Nigeria from these two causes alone add up to a staggering figure.

If, for the purpose of illustration, it is assumed that the annual loss through the above two causes is 20,000 tons of cocoa (this is considered to be an under-estimate), this amount at £250 per ton represents £5 million. The expenditure of £1 million annually on research and experiments to find a practicable means of substantially reducing these losses might be considered a modest outlay in these circumstances.

If Nigeria can solve some of the major problems which beset the cocoa farms, the future for the industry is very bright.

Venezuelan Agricultural Service Headquarters

Consisting of offices, laboratories, workshops and an insectary, the new headquarters of an Agricultural Service for Venezuela were opened near the town of Cagua, in the State of Aragua, early this month. This service, sponsored by Cia. Shell de Venezuela, was established early in 1952 and has hitherto been functioning from a provisional office. The opening ceremony was attended by many distinguished people, including the Minister of Agriculture and the Minister of Mines and Hydrocarbons. The new buildings were blessed by the Archbishop of Caracas, Primate of Venezuela.

The Shell Agricultural Service has been set up to contribute toward the development of agriculture in Venezuela by investigating problems affecting basic agriculture and by giving advice to farmers. A farm of almost 120 acres has been established in the centre of one of the chief agricultural regions of the country, on the Suata irrigation system near Cagua. An important factor governing the selection of this area is that it is within 10 miles of Maracay, where are located the National Agricultural Institute and the School of Agronomy of the Central University of Venezuela. The service maintains close contact with both these organisations and collaborates with them in the study of agricultural problems.

The service is divided into four sections: agronomy, entomology, phytopathology and agricultural engineering. Each one of these sections is headed by a man of a specific academic background assisted by trained staff. In studying and investigating such matters as the correct application of insecticides for the control and elimination of insects, the establishment of modern cultivation systems, the control of weeds and plant diseases, the adequate use of irrigation water, economic farming methods and choice of seeds, the experts of the service carry out experimental work on the Cagua farm or on the properties of nearby farmers, seeking practical and immediate solutions. Of equal importance is the extension work through which farmers' problems are brought to the service for investigation and advice. Further, the service will, in due course, publish the findings from its experiments and make these available in appropriate form to Venezuelan farmers.

It is expected that this practical effort to solve the country's agricultural problems will result in improved yields of rice, cotton, sugar cane and many other crops throughout Venezuela.

Classified Glossary of Terms Relating to Agricultural Machinery and Implements

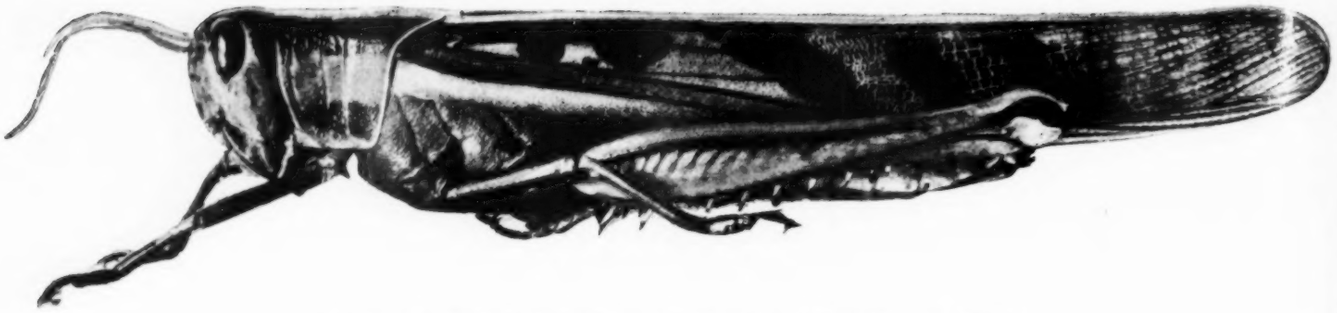
The latest document to be published by the British Standards Institution in the agricultural field is one of very real interest to everyone connected with the provision and use of farm machinery.

B.S. 2468 : 54 is the first glossary of terms for agricultural machinery to be issued by any national body, and the importance attached to this document has been evidenced by enquiries made during its preparation by organisations, governmental and private, in the United States, the Commonwealth and all the Continental countries. The International Organisation for Standardisation has decided to use the British glossary as a document of basic reference in its work of preparing standards for agricultural machinery and implements.

The object has been to standardise and co-ordinate the meaning of terms used daily in the agricultural world, where so often confusion is caused by one or more synonyms being used for a machine or a component, some terms being purely local in origin. Probably agricultural machinery, with its long history of evolution and its widely scattered usage, suffers more from a multi-varied terminology than any other engineering product. The universal advantages to be gained from the use of this glossary cannot be over-emphasised.

B.S. 2468 : 54 contains definitions of more than 400 items. No alternative or local terms have been used. Each carefully chosen name and concise definition has been determined by a committee of qualified agriculturists from widely separated parts of the United Kingdom. The initial draft was extensively circulated to British industry and abroad and the resultant comments were carefully considered and applied where necessary.

The B.S.I. intends to continue this useful work by preparing an extension of the present issue, thereby widening the scope of the document and increasing the range of machines, parts and accessories in the various divisions of agricultural work already covered. The new standard can be obtained from the British Standards Institution, British Standards House, 2 Park Street, London, W.1, price 6s.



Specimen of a female red locust, *Nomadacris septemfasciata* **(Serv.)**

An International Organisation for the Control of the Red Locust

D. F. VESEY-FITZGERALD, M.B.E., B.Sc.

Senior Scientific Officer, International Red Locust Control Service

The red locust* (Nomadacris septemfasciata) *has a wide range of occurrence in Africa, but serious outbreaks and damage by this form are for the most part confined to the southern parts of the African continent. The International Locust Conference of 1938 recommended that an international organisation should be set up to control this pest and the Red Locust Service was accordingly established. The present position in this regard is summarised below. The author, Mr. D. F. Vesey-Fitzgerald, is senior scientific officer of the service and is a recognised authority on matters relating to locust control.

THE International Red Locust Control Service at Abercorn, Northern Rhodesia, is working out a new method of controlling locust swarms at their source. Up to the last decade or two, the only defence was to attack the swarms as they advanced towards standing crops. The effort was usually too late, or might at best serve to drive the insects from one area of cultivation to another; it was always costly and the money might be spent to little purpose. The next step was to try and meet the swarms halfway, as is at present being done against the Desert locusts. For this purpose control operations are carried out in remote deserts and uncultivated places before the locusts can start causing damage to crops. Large numbers are destroyed in this way, but the method is very costly because of the remoteness of the places to which personnel, machines, and supplies have to be taken. It is, moreover, a never ending struggle, because the last swarm can never be destroyed. Fresh breeding leads to new swarms and a renewed threat to cultivated land.

Points of origin of Red locust swarms

Meanwhile research workers had come to the conclusion that swarm formation begins only under special circumstances of climate, terrain and vegetation. Exactly what the combination of factors may be is not yet understood for any species of locust. But in the case of the Red locust, field surveys indicate that for some reason or other swarms only originate in certain special places. Of such possible spots the Rukwa valley in south-western Tanganyika Territory and the Mweru Marsh in north-eastern Northern Rhodesia, appear to be the most dangerous. Much still remains to be found out about these outbreak areas and exactly why swarms might be formed there and nowhere else. But the idea that locust swarms might be controlled at their source opened hopeful possibilities of solving one of the world's locust problems, just when world food production is becoming of such great importance.

The Red Locust Organisation

At the 5th International Locust Conference held in Brussels in 1938, it was recommended that an international organisation should be formed with a view to preventing outbreaks of the Red locust. Work was begun from headquarters at Abercorn in 1941, and the service was formally inaugurated by international treaty in 1949.

Its functions

The functions of the service were to organise permanent control of known outbreak areas of the Red locust and to investigate regions suspected of being sources of origin of Red locust swarms, to take steps for the immediate destruction of any incipient swarms discovered in outbreak areas, to organise an information service on the movement and breeding of swarms which might have spread outside the outbreak areas, and to study the habits and the ecology of the Red locust and methods for its control. Funds are provided in fixed proportions by the participating governments, which include Southern and Northern Rhodesia, Nyasaland, Belgian Congo, Ruanda-Urundi, the Union of South Africa, the East African Territories of Uganda, Kenya, and Tanganyika, and more recently, the Portuguese colonies of Angola and Mozambique.

In operation the work falls naturally into two parts: first, the continual reduction of the locust population in the outbreak areas, with the object of preventing swarms developing; and second, studying the conditions under which swarms are produced

in the outbreak areas, with the object of so altering the conditions that there is no further risk of swarms being produced.

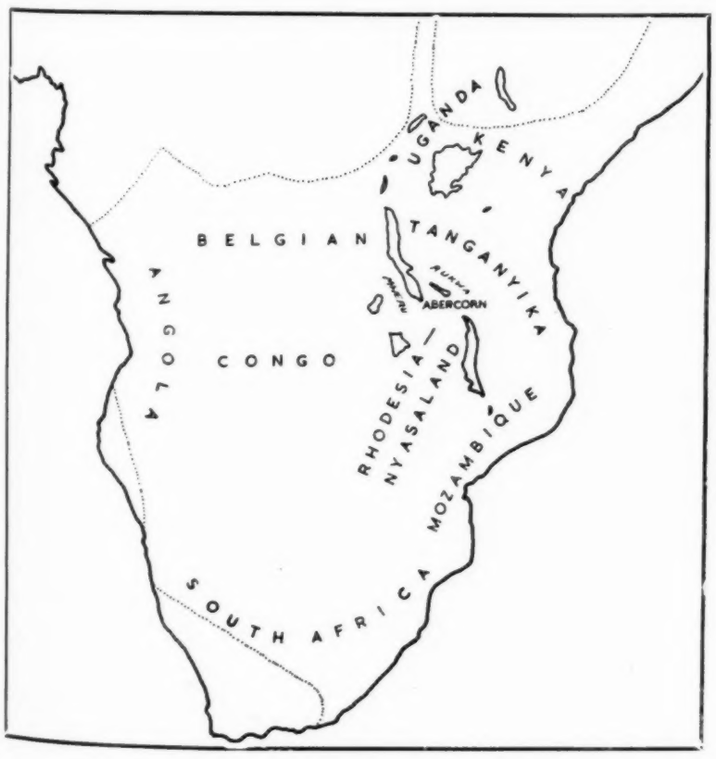
The ecology of the outbreak areas

If the Rukwa Valley and Mweru Marsh are the only dangerous outbreak areas, and since the Red locust is much more widespread than this in Africa, there must be something peculiar in the ecology of these places which tends to cause swarms to develop in them. If the nature of this peculiarity can be discovered, and if it could be modified sufficiently, perhaps the Red locust danger could be eliminated for all time without continual expense. It is also possible that success in dealing with the Red locust problem in this way might be valuable in solving the problems of other species of locusts. There is, however, a difficulty in that in preventing the formation of swarms, the control side of the service prevents the research side from studying the process of swarm formation. To some extent this difficulty has been got round by setting aside an area of some 25 sq. miles as a locust reserve, in which no killing is normally allowed.

The areas involved, approximately 1,000 sq. miles in the Rukwa Valley and about 250 sq. miles in the Mweru marsh, are of course ridiculously small compared with the territories covered by the Desert locust control teams. Correspondingly the work is less expensive, the service costing nearly £200,000 a year. Part of this expenditure is attributable to the fact that the outbreak areas are located in undeveloped parts of Africa and so an expensive programme of road building, bridging, and camp construction had to be undertaken. Because of the large increase in locust population that can occur in a small area in one breeding season the service has to be maintained in a continual state of preparedness, so that expenditure also goes on even when no locusts are being killed. Locusts are indeed killed even when their numbers are low, and although this may not seem to be an economical practice, it uses an organisation which would otherwise be idle although in readiness, and it continually depresses the level of population from which an upsurge would have to start.

Control measures

Before any control measures can be applied the locusts have to be detected and reported. This work is done by a staff of European scouting officers who supervise African scouts who patrol the outbreak areas. Simplified population sampling methods have been devised for application by the scouts, who submit regular quantitative reports of the locust situation in each area. Against adult locusts, control is undertaken when the population rises to as little as 1 per sq. yd. Hoppers are more difficult to estimate, because they occur in usually small, sometimes dense, generally scattered patches, but once found they are easier to control. A decade ago, locust hoppers were attacked entirely by hand methods and adults were not attacked at all. The non-chemical, mechanical methods included beating, burning, and sometimes, even, the burial of hopper bands which had been driven into trenches. The chemical methods consisted of arsenical spraying with stirrup pumps and hand-distributed arsenical baits. The mechanical methods were extremely laborious and rather ineffective; the chemical methods were more effective but still extravagant of labour and, using arsenic, somewhat dangerous.



This map shows the position of the outbreak centres, and the boundary of infestation areas, at the height of a locust plague

Modern methods of control

In 1947, mechanisation trials were begun. Anson aircraft were used for spraying 20% DNC and 2% gamma-BHC insecticide solutions against roosting adult swarms in the Rukwa Valley. DNC was found to be highly effective at dosages of 1 gal. per acre, but the gamma-BHC was not competitive at these dosages. D. L. Gunn, who was responsible for the trials, concluded that aircraft could be used successfully for Red locust control at a high total cost although the cost per acre of swarm might not be so high if the scale of operations was large enough. He emphasised the desirability of developing ground machinery capable of treating locust infestations at the rate of acres per minute, using low area dosages, so that routine control of adults could be carried out without resort to aircraft.

Insecticides employed

DNC was adopted for use as a contact insecticide, and it was at first applied by high-pressure, high-volume, lance sprayers that happened to be available. These machines have a small spray range and had to be used at night, when the roosting locusts were least likely to fly out of range. Water, which was needed for insecticide dilution, had to be transported long distances in the dry season and the necessity for developing concentrated insecticidal sprays for low dosage application by suitable machines became apparent.

Machinery used

For controlling hoppers, gamma-BHC dispersible powders were introduced in 1945, bringing with them the advantages of low human toxicity hazards. In the change over to mechanised control, which also began in 1947, drift dusting machines were acquired for powder distribution, but African labour forces still had to be used for hand-spraying, applying gamma-BHC suspension from stirrup pumps, when the waterlogged terrain would not allow machine movements. In 1950, six Buffalo Turbine drift-spraying machines were pur-

chased and performed sterling work against adult locust concentrations in 1951. The service still places main reliance on these machines for adult locust spraying.

Airflow turbine machines

Meanwhile, the prototype Airflow Turbine spraying machine was being developed by Dr. H. G. H. Kearns at Long Ashton, in response to the need for a powerful ground-operating drift-sprayer. In the last two years, the machine has been tested in operation against locust infestations. It had proved superior to the Buffalo Turbine machine and it is capable of treating about 3 acres of infestation per spraying minute when drawn at a speed of 3 m.p.h., the insecticide being applied at a mean area dosage of about 1 gal. of 20% DNC per acre. The prototype has served to reveal weaknesses which are being removed in commercial machines that are now being produced. For treating the large, extensive, adult locust infestations that may occur, it is proposed to use suitable machines of this type.

Commercial patterns tested

Commercial patterns which have been tested included the 'Micron' Sprayer, Anti-locust Model, and the 'Mistejecta.' These machines have several attractive performance features, but they have not been in use long enough to test their endurance and to show how they fit in to the very varied conditions of terrain and weather. However good the machine it is useless unless it can be moved to the locusts and then taken along regular spraying runs. The choice of trailers and tractors is thus of first importance and cannot be separated from the choice of spraying machines. All must be studied as compound units in actual operating conditions.

Clusters of red locust hoppers on grass stems form a target for insecticidal operations

For attacking hoppers in the rainy season, motor-driven and motor-drawn dusting machines sometimes cannot be used because of flooded ground. The old method with stirrup pumps can be used in these circumstances, but the acreage covered per man-day is extraordinarily low. Large-scale trials have been made in 1954, using cheap little dusting bellows, and the analyses of the results is awaited with great interest.

Environmental types in outbreak areas

From the ecological angle, considerable progress has been made in recognising the type of environment associated with outbreak areas. All the places in which a very widely fluctuating resident locust population has been found to exist are low-lying areas of valley grassland with sluggish, impeded, or even reversed drainage. In the rains, which may fall during six months of the year, the country becomes flooded and the dense grass stands may grow over 6 ft. high. During the drought which follows, the country dries out completely, and the grasses get burnt, leaving the bare soil exposed.

Critical periods

The Red locusts survive this extreme variation in conditions, but the success of their breeding and probably the risk of their swarming appears to be conditioned by the critical periods at the beginning and end of the rains, when drought is replaced by flood and vice versa. If these violent extremes imposed upon the environment by the climate, by drainage, and by fire could be smoothed out, it seems reasonable to suppose that the risk of violent fluctuations of the locust population might also be reduced.

To this end, therefore, efforts are being made to control the incidence of fire and water in the outbreak areas.

(*continued on page 279*)

Briggs-Hardy pump mounted on a tank transporter trailer drawn by a caterpillar tractor spraying 2% DNC on locust hopper bands in typical habitat of long and short grass

Mechanical Handling

Part 2—At Farm Buildings

P. H. SOUTHWELL

Mechanical handling in farm field work was the subject of a preceding article and the author now deals specifically with the movement of materials in storage and processing at farm buildings. The mechanisation of stock feeding and manure handling is also discussed together with some mention of dairy installations.

SYSTEMS for handling materials in and around farm buildings cannot be entirely divorced from the methods which are employed in the corresponding field work, since various commodities are despatched and received in bulk (*i.e.* in large units such as loose trailer loads) or in sacks or bales (*i.e.* small packaged units) according to the field system. Nevertheless, a continuous-flow handling system can be used in many cases; this means that a continuous stream of loose or packaged material is being conveyed whenever the equipment is operating. A continuous-flow system is more efficient than an intermittent-flow system (as employed in field transportation) since there are no idle return journeys of machines or men.

Most machinery for mechanical handling *inside* farm buildings does not need to be more than semi-portable; nor is flexibility a prime factor because movement of a single type of load over short, fixed routes is usually entailed. In fact, certain specialised tasks warrant permanent or semi-permanent installations, but some degree of portability is often desirable.

The various types of handling work *around* farm buildings tend to be of a less specialised nature and necessitate greater mobility and flexibility of equipment. Some multi-purpose machinery can be profitably employed for work both in the field and at the homestead; an example is the type of general-purpose elevator which can pick up hay or straw when towed in the field and can also be used without pick-up device or tow-bar for work at a barn or stackyard. An elevator gives continuous-flow handling, but a tractor with front-end loader which is carrying manure out of a yard constitutes an intermittent-flow unit. Many of the tasks around farm buildings are necessarily intermittent-flow and tractor-mounted loaders with various attachments are being increasingly applied.

Loading and unloading

Considerable work and time is involved at farm buildings in the loading and unloading of vehicles and in the filling and emptying of storage space; this can be assisted by full utilisation of the force of gravity.

The ideal situation for farm buildings from this point of view is on sloping ground. Materials can then be unloaded from vehicles on the uphill side and loaded into vehicles on the downhill side, as illustrated in Fig. 1. As well as facilitating the frequent unloading and loading operations, this arrangement also assists movement inside a building and the flow of material through a processing plant—such as a hammer-mill.

In the absence of this initial advantage of farm site, however, much can be gained by the use of different levels for the movement of materials between individual vehicles and between vehicles and buildings, particularly in the case of loose (non-packaged) loads. For example, a ramp built up to greater than vehicle height is advantageous for emptying tipping trailers into road or rail transport: a particular instance occurs in the movement of sugar-beet between field and factory. Similarly, the excavation of a pit into which trailer loads of loose grain can be tipped results in speedier handling at the storage site or drier.

Storage of material on an upper floor permits easy loading of vehicles from farm buildings, but the material must first be raised to the required height; some lifting device is also necessary for loading vehicles from ground level. A hoist, preferably electrically-operated, is particularly useful for lifting sacks from a vehicle into a top

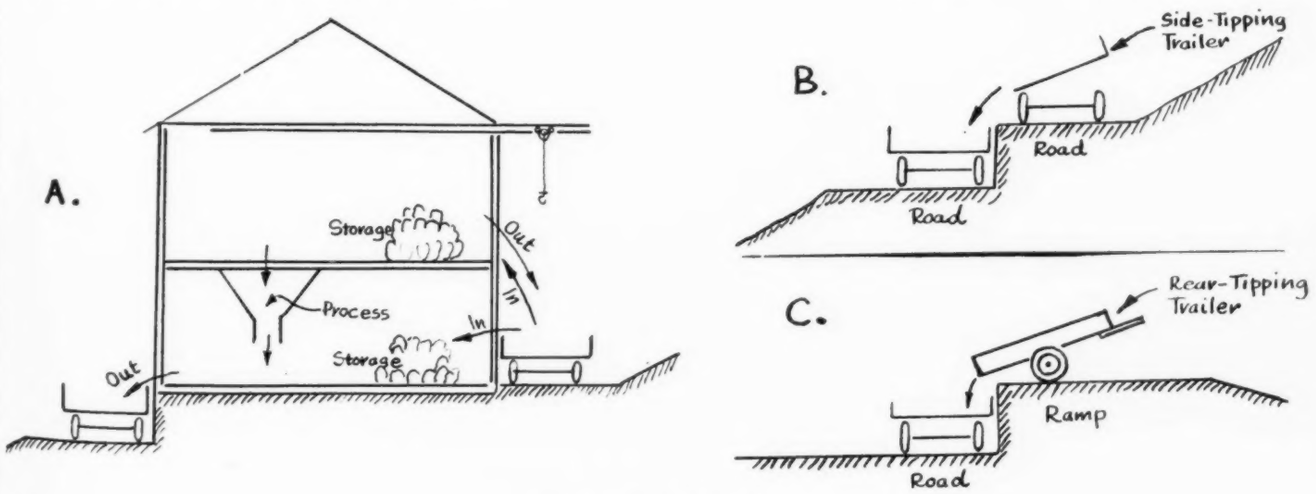


Fig. 1.—Use of levels

Fig. 2.—(*Above and right*) **General purpose elevators for handling a variety of loose and packaged loads**

floor. This is especially so if the hoist is mounted on a rail so that it can be moved inside the building along the whole width or length; if a suitable rail system is installed, the hoist can be utilised for stacking sacks or bales in the storage space. This same equipment may also be used with a sling, harpoon or grab for unloading loose hay or straw into a barn, but in all cases a quick, yet strong, means of holding and releasing the load is required.

Unless it can be used as a chute or operated 'in reverse' at a controlled speed, a general-purpose elevator has the disadvantage that it cannot be employed to unload the upper storey of a building into a vehicle below. This does not apply with hoists, nor in the case of the pneumatic methods of continuous-flow conveying which can be used with loose grain or chopped fodder. Small mechanical elevators can be used for the loading of vehicles from ground level and may even be attached to and driven from the vehicle; other similar devices for this type of work are also available but most of them cannot be used for unloading to a lower level.

Greater flexibility of equipment has, however, resulted from the introduction of tractor 'fore-loaders.' The variety of attachments, such as forks, grabs, scoops and platforms, which can be used with the hydraulically-operated lift arms make the tractor particularly versatile for various tasks around farm buildings. A tractor so equipped can be used, for example, to load and unload vehicles carrying a wide variety of commodities; furthermore, given sufficient height of lift (with or without an extension jib) it can be used for stacking sacks and bales as well as implements which are out of use. The value of tractor-mounted equipment is particularly notable when material has to be carried from covered yards or bays prior to loading.

Manure handling

The handling of farmyard manure has in the past presented severe problems, but manure handling outside buildings has now been reduced to a simple series of operations with hydraulically-operated, tractor-mounted tools. This has not only resulted in a marked reduction in labour requirement but also in a much higher rate of work (tons per hour).

The most useful equipment for loading farmyard manure from a heap or stockyard has proved to be a tractor with fore-loader and fork. The latter is filled in the lowered position by moving the tractor forward; the fork is then raised by hydraulic pressure acting in cylinders and the tractor is moved so as to transport the load to the trailer or spreader, into which it is discharged by tilting the fork. A grab may also be used in a similar manner, and if the tractor is fitted with an automatically engaging hitch to the spreader, the whole operation can be rapidly carried out by one man with one power unit.

A tractor with fore-loader and fork can also, of course, be used to carry manure from a stockyard to an adjacent heap pending distribution or, providing there is sufficient room to operate, from the inside of a cowshed or piggery to the storage site. The latter arrangement, however, requires passages of suitable width through the building together with doors at each end.

Movement inside livestock buildings

A complicating factor in connection with materials handling at the homestead is the architecture of existing buildings; this strongly influences the choice of movement systems and machinery layouts. A stockyard or milking shed, for instance, is preferably designed in accordance with a particular method of bringing in fodder and taking out manure. It is also very

desirable that the movement of different materials both in and out of the building should be carried out with the same basic equipment, using various attachments. If a hand-truck or a tractor with trailer and/or mounted tools is employed, it is necessary to have suitable passages down the length of the building and an easy circuit round and through the building; time should not be wasted in manoeuvring round an awkward route, as illustrated in Fig. 4.

The use of small hand-trucks, particularly those with detachable bodies, is far better than manual carrying, but considerable effort may be required to move them outside buildings, *i.e.* on poor surfaces. A small tractor can profitably be employed with two separate trailers when straw and fodder have to be brought some distance and manure has to be removed to a field

for storage. When the distances involved are short, a tractor with front and rear lift arms can be used with a fork or scraper to remove manure and with a fork, scoop or platform to bring in fodder. This has the advantage that the materials can be picked up, instead of having to be lifted into a truck or trailer, and straw or fodder can be dropped at intervals through the building without the need for manual effort in unloading. The availability of a tractor may also permit the application of other labour-saving devices, such as a revolving-brush sweeper for use when cleaning and washing milking sheds, for example.

An alternative method of moving the various materials is by means of an overhead rail system carrying roller units to which buckets, slings and grabs, etc., can be attached through a swivel pin and a light, quick-action pulley block. As is the case with hoists mounted on rails, this equipment requires an adequately strong roof structure, but has the considerable advantage that it takes up no floor space; this is an advantage in a piggery or a calf-rearing house, for example, because only narrow passages are needed. In the case of a dairy, the overhead rail may also carry churns or other containers, and even support the milking units for easy movement along the building. A complete rail system can thus transport everything which must be brought in or taken out of the milking shed as well as assisting in the other work which is carried out.

The use of tractors and allied equipment for the movement of materials inside buildings is most suited to small or medium mixed farms because the same machinery is then available for other work throughout the greater part of the day; however, the wide passages required and consequent waste of floor space in buildings for housing stock may not always be acceptable. A permanent structure such as an overhead rail system is most suited to large buildings where specialised routine work must be rapidly carried out a number of times each day. It is in this type of building (dairies, for example) that time and motion study is most valuable and permanent, comprehensive mechanical handling equipment reduces labour requirements to offset capital expenditure in a relatively short time. This point is not so important with general-purpose machinery based on tractor power and, in either case, mechanical handling devices are likely to play a major part towards cost reduction in intensive livestock farming.

Another example of fixed and specialised equipment is the application of conveyor belts in poultry battery houses. Endless belts, preferably driven by electrical power, can be used to feed and water the birds as well as to remove manure and eggs; moreover, the system can be fully automatic if controlled by time-switches. Conveyor belts are, however, most often employed in continuous-flow operations and particularly in processing and packaging.

Processing plants

Conveyor belts of the open chain or closed rubber/canvas type are widely used for horizontal movements of material in various processes at farm buildings, and they often form part of a machine: an example of this occurs in conveyor-type grain and grass driers. A reciprocating grid (shaker) may be employed for the same purpose and a solid rubber or canvas belt can also be utilised to carry material away from the discharge of a processing machine, such as a drier, into a storage building. Endless conveyors fitted with tines or buckets are commonly employed to elevate grass or grain respectively into mechanically-operated driers, but bucket elevators cannot readily be used for horizontal movement.

Another means of movement in both horizontal and vertical planes is the screw or auger; this is mainly applicable over short distances and an adaptation of the principle is applied in some food-mixers. These machines may be regarded as mechanical handling devices which, like hammer-mills and rolling mills, have considerably reduced the manual effort involved in stock feeding. In the case of hammer-mills, however, a means of conveying the finished product may easily be incorporated with the machine in the form of an ' impeller-blower '; this method is also applied in silage cutter-blowers. In both cases an impeller fan elevates material from the processing machine into a vertical duct and also creates an air flow in the duct which carries the material up to a discharge point. If a hammer-mill is fed from an overhead hopper by gravity and is fitted with an impeller-blower discharging into a cyclone, then no manual work is involved in the whole procedure—except in handling sacks at the outlet. Gravity feed systems, in which the raw material needs to be elevated by general-purpose machinery upon its receipt at the building, can also be used for grinding, crushing and kibbling mills, for example, but the finished products cannot be carried away pneumatically.

Pneumatic methods

Pneumatic methods of handling materials are widely used for the movement of threshed grain. In this case the fan does not come into contact with the conveyed material but is used to create a high air velocity and adequate pressure in a system of large-diameter pipes; the grain is fed into this air stream and becomes airborne so that it is carried along to the discharge point. A pneumatic grain-conveying system can effect movement in both horizontal and vertical planes, and portable ducting permits considerable variation of route. With any system, however, the necessary air velocity and pressure must be maintained to keep the material airborne and overcome the friction between the air / grain mixture and the pipe; when a flexible

Fig. 3.—Loading manure into a Ferguson manure spreader with a Ferguson high-lift loader

system is required, it is therefore necessary to provide a fan of sufficient maximum capacity.

Pneumatic equipment for lifting grain by suction (instead of by blowing) is also available for unloading vehicles or for picking up grain to fill sacks, for instance. Furthermore, an air flow can be used for drying and pneumatic conveyance is normally an integral part of pneumatic grain and grass driers of the low- or high-temperature types. Pneumatic conveying systems are commonly combined with ventilated-silo grain drying and storage installations ; thus manual handling is eliminated from these processes.

An air velocity in a vertical duct can also be used to clean grain or to grade it by differentiating between various sizes of grains having different terminal velocities.

Grading and packing

Pneumatic methods cannot, however, be employed to clean, grade or pack heavier farm products such as potatoes and vegetables. Most machinery for this type of work incorporates some form of mechanical conveyor and, as in the case of potatoes, a shaker or reciprocating type of conveyor may be used to promote cleaning as well as forming part of the grading process. Roller conveyors are employed in some vegetable washing machines and a rotary screen may also be used to effect movement through the various stages of a plant. In the case of easily damaged products like vegetables, washing is the only possible method of cleaning, and mechanisation of this process usually involves movement on some type of conveyor through a tank and/or between oscillating spray pipes. Rubber conveyors are normally employed for the gentle handling of eggs and fruit during grading and various specialised packing machinery is available which aims at eliminating human assistance from this type of work.

The movement of packages can be carried out by hoists, chutes and mechanical elevators or by tractor-mounted platform loaders, as outlined previously, but for work in large specialised plants other than at farm buildings, the fork-lift truck has been found to be a most valuable and versatile machine.

Power supply

The most convenient source of power for mechanical handling inside farm buildings is the electric motor. The best system is to have individual motors driving each piece of fixed equipment and, whenever possible, to transfer motors between intermittently used machines having similar speed and power requirements. As regards the cost of electricity supply to a farm, it is preferable to have a number of small motors operating more or less continuously rather than to have one very large motor running intermittently; this point obviously influences the choice (size) of machinery which is to be electrically driven.

On the other hand, portable machines such as general-purpose elevators are best equipped with their own internal-combustion engines so that they are unrestricted in range of action. Engines may also be used to drive various kinds of machinery in buildings from a common shaft when electricity is not available, but tractor power should, whenever possible, be used for this purpose in the case of machinery which is not in constant use. A tractor can drive the common shaft through a belt or, preferably, from the p.t.o. shaft and the desirable aim of full employment for farm power units is then more nearly reached. Tractors also need to be used for driving machinery which has a high power requirement, such as large hammer-mills, silage cutter-blowers and so forth, but their major application for mechanical handling work around farm buildings is likely to be with mounted equipment.

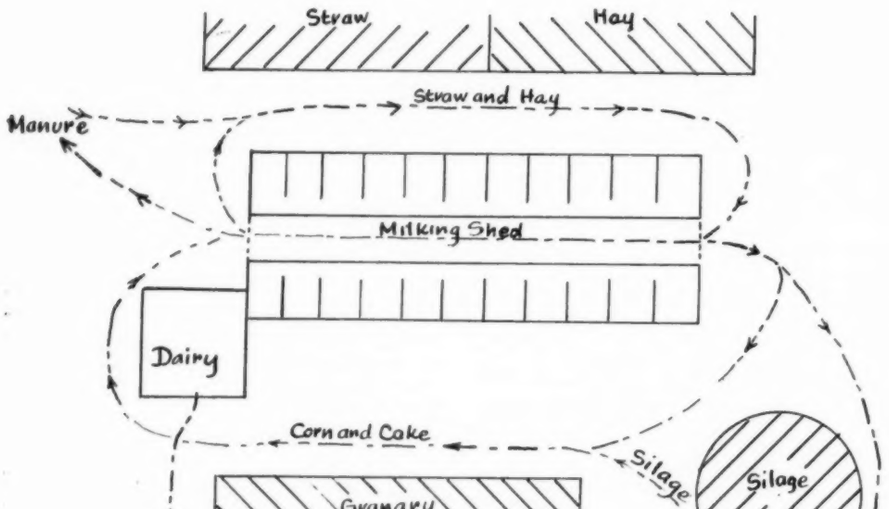


Fig. 4.—Equipment routes

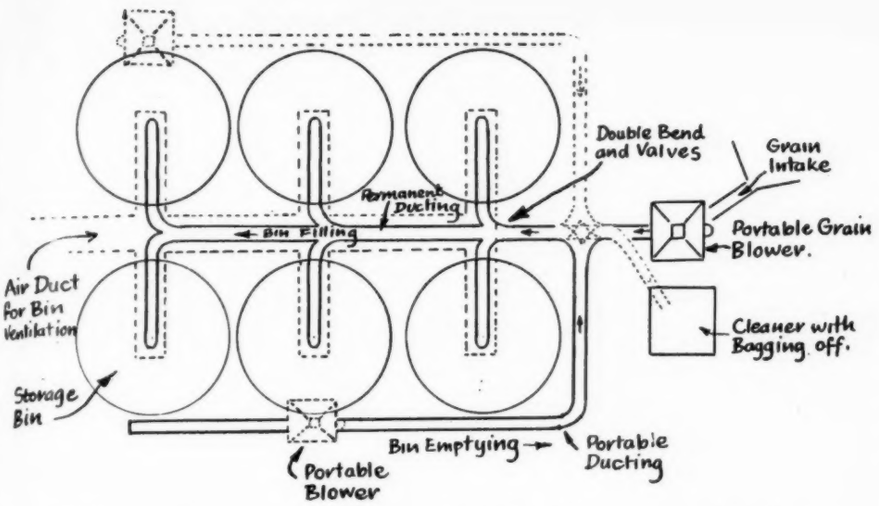


Fig. 5.—Pneumatic conveying system at grain storage installation for filling bins, transfer between bins and emptying bins

Conclusion

A considerable range of machines for mechanical handling in and around farm buildings is now available. The equipment used may be either specialised or general-purpose in application, according to the type of farm, and it is sensible to use general-purpose machinery whenever possible. It is for this reason that the value of tractor-based devices has been stressed.

In order to obtain maximum efficiency and minimum overall operating costs it is necessary that all equipment should be fully utilised; this applies particularly to power units. An elevator, for example, requires power to drive it even when carrying no load—since no useful work is being done, this power is wasted; furthermore, a costly engine which is frequently idle represents a corresponding waste of capital. Specialised equipment is necessary in milking installations, for example, where frequent routine work is involved, and is justified where there is a very large volume of work; but when in use it needs to be fully loaded and interchangeability of power units is highly desirable.

In order to achieve full employment, the organisation of farm work and labour must be geared to the equipment. The use of mechanical handling devices should not be merely an encouragement for laziness; to be economically justified it must speed up work and reduce labour requirements.

Photos: Fig. 2 (left), A. B. Blanch & Co., Ltd. (right) Hart Agricultural Engineering Co., Ltd., Fig. 3. Massey-Harris-Ferguson, Ltd.

The Australian Sugar Industry

We have received from Mr. Norman King, the Director of the Bureau of Sugar Experiment Stations of Queensland, the following corrections to Mr. T. Hungerford's article on the Australian Sugar Industry which appeared in our February 1954 issue.

The number of sugar mills operating in Queensland and New South Wales are respectively 31 and 3 and not 34 and 2 as stated in the article. The Mackay district of Queensland has the lowest production of cane of all Queensland districts.

In regard to mechanical planting the article might be read as inferring that planting by hand was carried out until comparatively recently. Queensland actually, it is claimed, led the world in the mechanical cultivation of sugar cane, and mechanical planters have been widely used for 30 years or more, while cutter planters, as mentioned in the article, have tended to replace them during the last 15 years.

The usual fertiliser dressing in the Queensland area is 3 to 3½ cwt. of a mixed fertiliser to which is added 37 lb. of gammexane to protect the setts not only against the White grubs but also against the wire-worm (*Lacon variabilis*), which is a serious pest in the districts of Mackay and Prosperpine.

It is incorrect to state that cane cutters follow the cane from district to district since from July to November all districts are harvesting simultaneously, and the cutters are signed up on contract to harvest the entire crop on the farm where they are employed, although towards the end of the season cutters from areas which finish crushing early may seek employment in a district where harvest is still proceeding.

It should also be stated that the bulk of the cane in Queensland is not loaded mechanically. It is doubtful if more than 2% is handled by machine.

The Bureau of Sugar Experiment Stations is not a branch of the Queensland Government Department of Agriculture nor does it serve all growers. It is the research organisation of the Queensland sugar industry but plays no part in the small New South Wales industry.

WORLD CROPS

IN OUR NEXT ISSUE will appear Part 2, **The British Cameroons,** of the article on the cocoa industry in Nigeria and the Cameroons by D. H. Urquhart and G. A. Ross Wood. G. C. Denham will be writing on the **Tea Industry in Indonesia,** and Frank Princi will discuss the **Toxicity Hazard of Aldrin, Dieldrin and other Chlorinated Hydrocarbon Insecticides.** There will also be in this issue other articles and the usual features.

International Organisation for the Control of the Red Locust

(*continued from page 272*)

Already it has been demonstrated that the mosaic of vegetation which characterises the locust areas is largely dependent on the drainage and is accentuated by differential burning of the grassland, drought and fire combining to produce patches of bare soil which are particularly favoured by the locusts as oviposition sites. If the grass cover can be preserved during the dry season, such oviposition sites may be reduced and, moreover, if the grasslands remain choked with last year's straw, vast areas can often be burnt during a dry spell in the wet season and all the contained locust hoppers destroyed cheaply and efficiently.

The outbreak areas are at the present time almost entirely unproductive, and an attempt is being made to convert these useless environments into pasture, paddy lands, or tree plantations. Such measures might change them from a threat to Africa's crops to an addition to the production of the continent.

Natural Factors and Their Influences on Tea Production

N. G. GOKHALE, B.Sc.

Indian Tea Association, Tocklai Experimental Station, India

In this article, the author, who is Physical Chemist on the research staff of the Indian Tea Association, describes and discusses some of the factors which influence the growth of the tea crop in North East India. It should be appreciated that what is described may not be applicable to other tea areas of the world. The article is a continuation of those published in the May issue of* WORLD CROPS, *which was mainly concerned with the tea industry.

THE growth of a plant in the field depends partly on internal factors and partly on factors which are external to the plant. The internal factors are those innate to the plant itself. The external factors are the influences exerted on the crop by nature such as soil and climatic conditions, the influences exerted by man such as manuring, cultivation, etc., and the effects of pests and diseases; in fact the whole environment of the crop. Some of these factors may be termed the ' Natural ' factors—the remainder are within the possible control of man. One may therefore group the different factors as under:

1. *Natural factors:* Soil, climate, altitude, topography and aspect.
2. *Controllable factors:* Kind of tea, manuring, shade, pruning, plucking, cultivation, etc.

The influences of the natural factors on plant growth are far reaching. Some people go as far as to hold the view that it is geographical location alone which decides yield and quality. This of course is an extreme view with which it is not possible to agree entirely. It is fully possible to bring about wide changes in both yield and quality by attention to such points as planting the appropriate kind of tea, optimum manuring and maintenance of shade, system of plucking, care in manufacture, etc. It is even possible to bring about some minor but nevertheless significant changes in the crop environment, especially soil conditions. For example, it is quite easy to increase soil acidity. Similarly, although one can do little about climate, irrigation is a possibility to be considered in areas which suffer from drought periodically. Whether or not these measures will prove to be economical is, however, another matter, and each case must be judged on its own merits.

A lot can be done through human effort, but at the same time it is true that the utmost results which it is possible to achieve vary from place to place and are influenced to a considerable extent by local conditions. Natural factors undoubtedly have a big say in deciding the crop variety, agricultural practices, production methods, etc., which are best suited to the given conditions. Considering everything, the real position would appear to be that natural factors do set some sort of an upper limit to the yield and quality of tea which it is possible to achieve in a given place.

An attempt will be made in this article to discuss, in brief outline, the direct as well as the indirect influences of natural factors on plant growth in the case of the tea areas of N.E. India.

Chemical properties of soils and crop potentials

Tea has certain specific requirements in respect of the chemical properties of soils.

Acidity

Perhaps the most important factor for successful tea cultivation is a pronounced acid condition of the soil. Not only is the top soil important but also the subsoil to a reasonable depth. The upper limit of *p*H varies with the nature of the soil, especially the amount of clay and organic matter fraction. Thus in the case of sandy soil it is usually desirable to have the *p*H below 5.8, but the corresponding figure in the case of a heavy soil may be even lower. Soils with *p*H above 6 are definitely in need of some treatment if tea is to be made to thrive thereon. As regards the lower limit of *p*H, no case has yet been reported in N.E. India of tea not doing well because the soil was too acid. The *p*H of the water extract alone does not always give enough information, and in some cases therefore determinations of exchange and hydrolytic acidities are also carried out. These are the acidities developed when the soil is leached with a neutral salt and a salt that hydrolyses respectively. The tests are empirical and the results obtained are arbitrary, but they can be of great practical value. Thus in N.E. India, in deciding on the suitability of a soil in respect of acidity, great reliance has been placed in the past on the *p*H value of the extract with potassium nitrate.

It is easy to increase acidity of a soil by application of sulphur. The quantity required to bring about a given change naturally varies with the type of soil: a sandy soil with little buffering capacity requires very much less than a heavy soil. Sulphate of ammonia, which is commonly used for tea in N.E. India, also makes the soil acid.

Lime content

The tea plant has been described as being a calcifuge, and the general experience all over the world is that a soil which contains an appreciable amount of free calcium is not very suitable for tea. The lime content of the good tea soils of N.E. India lies between 0.1 and 0.2%, about half of which may be soluble in 1% citric acid. The tea plant is tolerant of small quantities of lime but will not thrive in a definitely calcareous soil. A number of field experiments have been carried out to study the effect of liming tea soils, and they all show that the general practice of liming is not to be recommended for tea.

Nitrogen and organic matter

Provided that the above conditions are satisfied first, the vigour of tea depends largely on the abundance of available nitrogen in the soil. In assessing the nitrogen status of a soil, it is preferable to consider it with reference to only the reactive portion of the soil. For example, the insoluble siliceous fraction may vary from 70% to just over 90%, depending on the nature of the soil, and identical standards cannot be used for all the soil types.

Thus, in the case of Jorhat sandy soil with say 92% insoluble siliceous matter, a nitrogen content of 0.09% gives luxuriant tea while in the case of another area a nitrogen content of even 0.15%, but with a silicate fraction of 80% may not give satisfactory results. The extreme case of the use of soils with a maximum organic matter content is presented by the bheels (*i.e.* peaty soils) of Surma Valley. In their case a nitrogen content of 0.6% is typical and values may go as high as 1.8%, with a corresponding organic matter content of up to 80%. These bheel soils are capable of giving enormous yields, exceeding 3,000 lb. of made tea per acre, at least initially, but such high yields cannot be maintained indefinitely as the bheel deteriorates rapidly. These peat soils are a very special case, but the importance of nitrogen and organic matter in the case of tea soils is clear. The general conclusion is that vigorous growth can be expected only if the values of nitrogen and organic matter content lie between certain limits. One may accept a figure of 0.8% nitrogen in the 'non-silicate' fraction as the minimum necessary for successful establishment of tea. Maintenance of an adequate level of nitrogen and organic matter in the soil, especially in the case of areas which have carried tea for long periods, is a problem which will come more and more into prominence in the years to come.

Phosphorous

There is some indication that provided normal growth is assured by an adequate level of nitrogen and organic matter, the quality of tea may be affected by the amount of available P_2O_5 in the soil. Whether applied phosphates in the case of deficient soils will prove economical, on this score alone, remains to be seen. It is possible that this may be so with certain kinds of tea.

Other constituents

There is no clear evidence as to the effect of the actual amount of potassium in the soil, but potash manuring is known to have some beneficial action against certain fungus diseases and the response may also depend on climatic conditions.

Aluminium and manganese may also have a bearing, but they are likely to act as limiting factors only when the soil is insufficiently acid. As regards aluminium it is interesting to note that the tea plant is an aluminium accumulator, and when the soil is insufficiently acid, supply of aluminium would be limited whereas the position would be exactly opposite with calcium. This then may be the real cause why tea does not do well on soils which are insufficiently acid. If this is so, then the

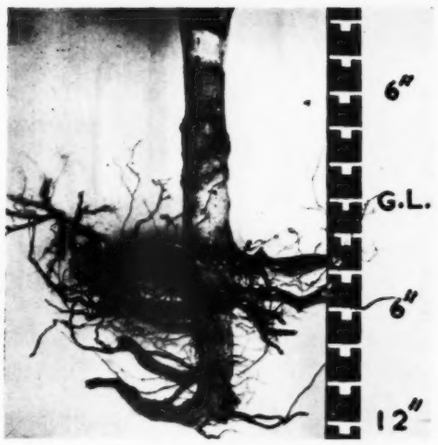


Fig. 1.—Typical shallow root system of a tea bush growing under adverse subsoil conditions

essential condition for optimum growth of tea in respect of acidity should preferably be expressed not in terms of *p*H but a certain balance between, say, the available aluminium and calcium.

As regards minor elements no cases have so far come to light in N.E. India of any deficiencies due to minor elements. The sulphur deficiency observed in East Africa is not likely in N.E. India in view of the regular application of sulphate of ammonia.

Deep and porous soil

In respect of the physical properties of soils there are also certain definite conditions which tea requires for optimum growth, and the most important of these is that the soil be deep and porous. As a rough rule it may be stated that a minimum available depth of say 5 ft. is desirable. Not only is the depth important but also the nature of the different strata. A condition such as a suitable top soil underlaid by a heavy clay is specially unfavourable. Fig. 1 shows the typical shallow root system of a tea bush growing under such conditions. Many instances have come to light of tea which does well initially, for, say, 5 to 10 years, but makes no further progress because of adverse subsoil conditions. In opening out fresh areas in tea gardens, planters are always advised to make sure on this point by digging inspection pits and examining the sub-strata.

Fig. 2.—Enlarged lenticels on roots of a tea bush

Texture

The ideal soil texture for tea is a sandy loam, but satisfactory results can be achieved on any light soil provided that it has a certain minimum water holding capacity. Tea planted on a very coarse sand is liable to suffer in a drought, although at other times the growth may be satisfactory. On the other hand, heavy soils are decidedly difficult to manage, especially as regards maintenance in proper tilth and drainage. Although the operative mechanism is entirely different, tea on a very heavy soil is also liable to suffer in a drought: in short, a heavy soil is a problem both during periods of excessive rain and of no rain. Establishment of tea on such areas is by no means an easy task. It is, however, known that rate of growth on a heavy soil is steadier, and often tea on a heavy soil gives better quality than on a sandy soil in the same district.

Air and water relationship

Although the water requirement of the tea plant is high, for successful cultivation it is essential that the top 3 ft. of the soil at least, should never remain in a saturated condition. On most tea gardens it is usually necessary to go in for some system of drainage, but each case has to be treated on its merits. Certain natural conditions of the topography and subsoil may have some advantages in this respect. For example, gently rolling land broken up by natural nullas (surface waterways) and having a good outfall would present little difficulty regarding drainage. If the soil remains in a waterlogged condition for considerable periods the tea bushes are attacked by Violet Root Rot, *Sphaerostilbe repens*.

Under certain soil conditions it is possible for the bushes to suffer from lack of aeration although the land is well-drained. Bushes growing under such conditions present a sickly and debilitated appearance and are prone to attack by various secondary fungus diseases. A characteristic feature of bushes suffering from lack of aeration of the soil is that their roots show enlarged lenticels (see Fig. 2), whereas normally the root surface is smooth.

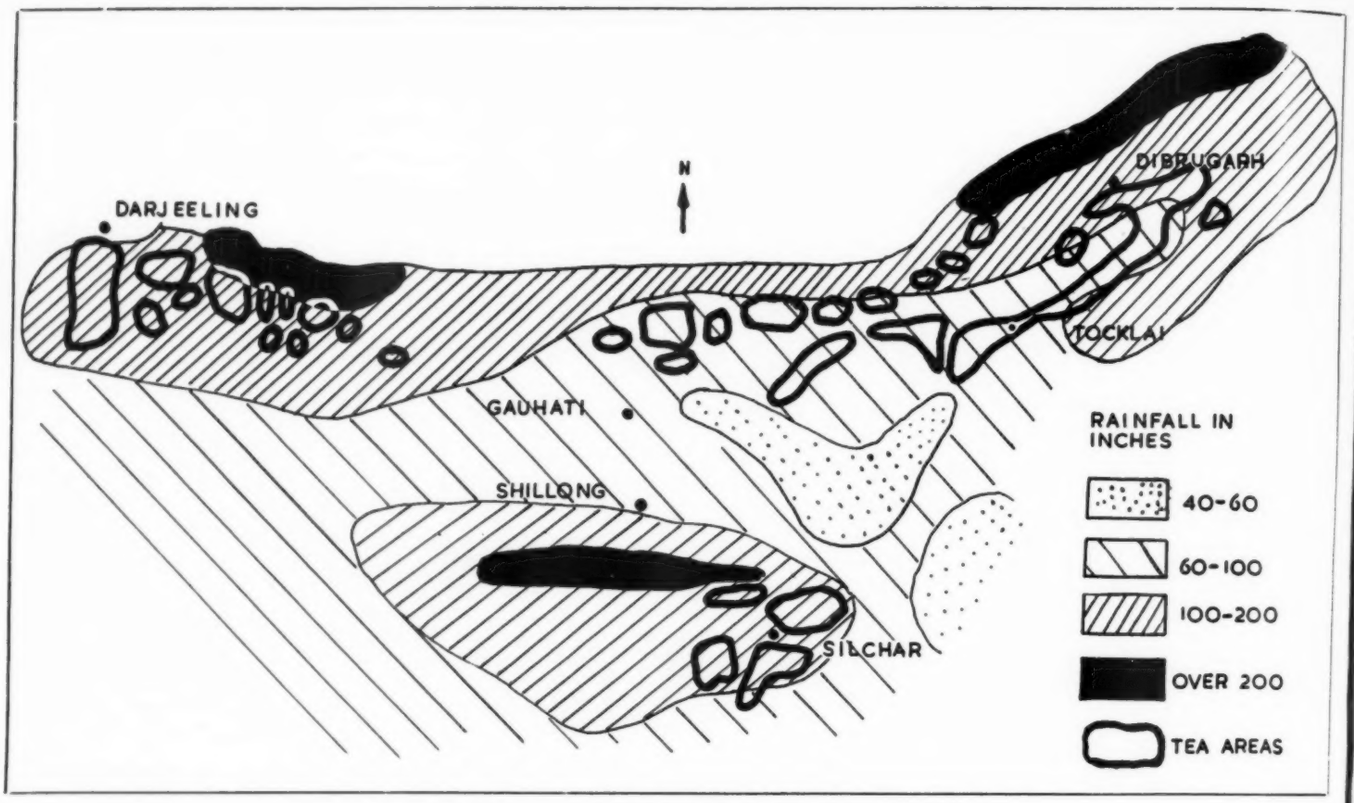


Fig. 3.—Mean annual rainfall of North-East India tea areas

Climate and crop potential

What suits tea best for optimum growth are continued hot-humid conditions, although naturally the degree of toleration varies with the kind of tea. Speaking in general, the water requirement of tea is high and the ideal condition is that there should be rarely a month with no rain. Prolonged periods of drought and especially simultanous hot and dry conditions are quite unfavourable for tea, especially for the type which is most desired. The minimum annual rainfall required for tea in N.E. India is put at 60 in., although a safe limit is more like 80 in. Fig. 3 shows the mean annual rainfall of the tea areas of N.E. India. Areas which receive less than 60 in. are not considered to be suitable for tea. One cannot be sure, even with a higher rainfall, if the distribution is not favourable, and there are in fact areas which receive 100 in. of rainfall and still periodically suffer from drought. A high relative humidity and absolute humidity are essential. It is especially important that when temperatures are high the humidity should also be high. In any case the shade temperatures during the hottest part of the year should not go much above 90°F., nor should they fall below the freezing point in winter. The rate of growth naturally depends on temperature. If optimum humidity is to be maintained, it follows that the diurnal variation of temperature should also be small.

The vital influence of climate on plant growth is seen best when one considers the seasonal variations in climatic conditions. Both the quality and yield are affected by climate. Second flush and autumnal teas are well known for their quality. During the rains, conditions in N.E. India are such that it is rather difficult to achieve a high level of quality. Similarly the yield of tea is influenced greatly by climatic conditions, and the distribution of the yearly rainfall is perhaps the most important single factor which determines yield. The marked variations in yield from year to year which can be ascribed to climate alone are too well recognised to need elaboration. Thus, in the case of gardens near Ranchi, Dehra Dun and Jalpaiguri the spring crop is dependent almost entirely on whether or not early rains occur. In areas where the rainfall is more reliable the effect may not be so prominent, but nevertheless it is still very definite.

The altitude topography aspect and crop potential

The effects of location could be explained in terms of either a climatic or soil factor, but it is preferable to group these separately. The effects of elevation are seen best when one compares a high-level Darjeeling tea garden with a garden in the plains. The rate of growth at high elevations is markedly lower on account of the lower temperatures prevailing, and this affects both yield and quality. The yield obtainable with ease in the plains cannot be attained in Darjeeling, and the actual elevational range of tea has a considerable bearing on the crop potential. Thus in Darjeeling, the yield may be under 350 lb. of made tea per acre at the high elevations but may reach 1,000 lb. or more at lower levels. On the other hand, in the plains much higher yields are possible and some tea areas actually exceed the 2,500 lb. mark.

Topography and aspect are also equally important considerations. The method of planting on slopes has to be different as adequate measures must be taken against soil erosion. In the Darjeeling area, where planting on slopes of 1 in 3 is the rule rather than the exception, the problems are quite different to those of tea planted on fairly flat land. The available depth of soil on slopes in Darjeeling is often no more than a few feet, whereas the position in the plains is quite different. Topography and aspect may also affect the position in other ways. For example, many areas in the Darjeeling district have comparatively little sun during the day as a result of their topographical situation. Similarly, the rainfall received by two gardens situated

on opposite sides of a valley, but no more than a few miles from each other, may differ widely. The importance of aspect can be seen not only in the Darjeeling hill district but also in other places. The sun-baked southern and south-western slopes of teelas (low hillocks) in the Surma Valley where tea is usually poor is a case in point. The difference in the condition of two adjoining areas of tea with opposite aspects is often very vivid.

The limitations imposed by natural factors on controllable factors

Although it is not possible to go into great detail, mention must be made of the indirect influences of natural factors on plant growth. At the commencement of this article some of the factors influencing plant growth have been described as being within the possible control of man. Theoretically they are within the full control of man, but the actual state of affairs in practice is likely to be very different and natural factors have a predominant influence. Thus, theoretically it is possible to plant any kind of tea wherever one likes, but experience will soon show the futility of any such action. Different kinds of tea do not grow equally well under varying sets of soil and climatic conditions, and therefore one's choice in the matter is necessarily restricted. The same applies to shade trees and leguminous crops. Natural factors also have a say in deciding the cultural systems which are best suited to the given set of conditions. For example, pruning is carried out annually in Assam, but a longer cycle is preferable in certain other areas. In the case of Darjeeling, the higher the elevation of tea the longer is the pruning cycle, and this has to be taken into consideration. Response to manuring is bound up closely with the soil and climatic conditions. Exactly identical results can neither be expected nor obtained in different places, and responses may also vary from year to year, depending on climatic conditions. Some of the natural factors, such as terrain, also bring in their wake problems which do not concern plant physiology but are more of an organisational nature. All these indirect influences have some ultimate effect on the crop potential.

Conclusion

An attempt has been made in this article to describe the vital and far-reaching influences of natural factors on tea production. There are certain well defined soil and climatic conditions under which tea thrives naturally. In areas where these optimum conditions are not obtained, entirely satisfactory results will not be possible. If tea is to be grown as a commercial proposition, it is surely a wise policy to make as full a use of existing natural conditions as possible. The principle must be accepted that it is always preferable to adopt the crop type and agricultural methods to suit the local conditions rather than attempt to grow a certain kind of plant under adverse conditions or, worse still, to go about the business in a haphazard manner.

Mechanical Tea Plucking in Russia

In our issue for May 1954, which was mainly devoted to the tea industry in various parts of the world, we included on page 194 an illustration of hedge planting of tea in Soviet Georgia and of a machine, invented by the Russians, for mechanically harvesting the crop. Since then we have received a further photograph of this machine, which shows it in greater detail; this we reproduce on this page.

The Russian mechanical tea plucker at work

The machine is self propelled and is reported to be in successful operation on the Adzhar plantations of Soviet Georgia along the Black Sea coast. When it is at work the machine straddles the row of tea bushes. Harvesting is carried out by a pair of multibladed rotary cutters, which shape the bushes. The harvested clippings fall into an underpan beneath the machine.

Tea has been cultivated in the Georgia region of Russia for many years. Cultivation has to be confined to regions which are secure from the occurrence of severe winter frosts. Nevertheless, tea cultivation is reported to be steadily extending. Last year it is claimed that an additional area of 11,000 acres came under tea cultivation in Georgia, and by the end of the year it is apparently anticipated by the Soviet authorities that a total area of 170,000 acres will have been established under tea in the subtropical region of Georgia.

Food Cultivation on Rubber Estates in Ceylon

The Ceylon Government has decided to enforce food cultivation on all rubber estates of 35 acres or more. Tea estates already come under this order. Estates unable to cultivate the prescribed 12% with food crops can instead contribute 10 rupees per acre to a food production fund.

Hydraulic Power in Farming with Track-Laying Type Tractors

FRANK P. HANSON

Caterpillar Tractor Co., Peoria, Illinois

FARMING today is big business. The gross farm income in the United States for 1950 is expected to be $31,500 million, but many people close to tractor and farming business do not appreciate the volume or value of track-type tractors sold for agricultural use. Therefore it may be of interest to state that in the U.S.A. 45.7% of all track-type tractors shipped in 1949 were for agricultural use. This 45.7% by units equalled 32.3% by value and the value was $64,482,000. This difference in percentage of total track-type tractors sold for agricultural use as compared to the percentage of total value is not surprising when one realises that the large contractor, logger, etc., uses large power units. Track-type tractors range in size from approximately 18 d.b.h.p. to 150 d.b.h.p.

The application of hydraulic power to track-type tractors will be considered under four sub-heads, namely:

(1) As part of the prime mover.
(2) Where the hydraulic jacks are part of the attached machines.
(3) Where the hydraulic jacks are movable or interchangeable between two or more machines.
(4) Hydraulic motors.

The use of hydraulics is increasing in relation to tractor operation and in this article the matter is discussed in relation to its application in connection with track-laying tractors under conditions in the U.S.A. For the article we are indebted to the Caterpillar Tractor Co., of Peoria, Illinois.

Hydraulic power as applied to the prime mover will be found in hydraulic steering units and torque converters or hydraulic clutches. Although both hydraulic steering and torque converters are in commercial production on track-type tractors, it is not intended that these applications of hydraulic power should be stressed in this paper.

Hydraulic power on attached machines

The application of hydraulic power where the jacks are fixed on machines attached to the tractors will be considered under the following types of machines:

Loaders. Fig. 1 shows a hydraulically-controlled loader being used to load manure on a New York State dairy farm. Perhaps all too frequently these machines are referred to as manure loaders when, as a matter of fact, one-man high-capacity loaders are being demanded in increasing numbers for many farm loading jobs.

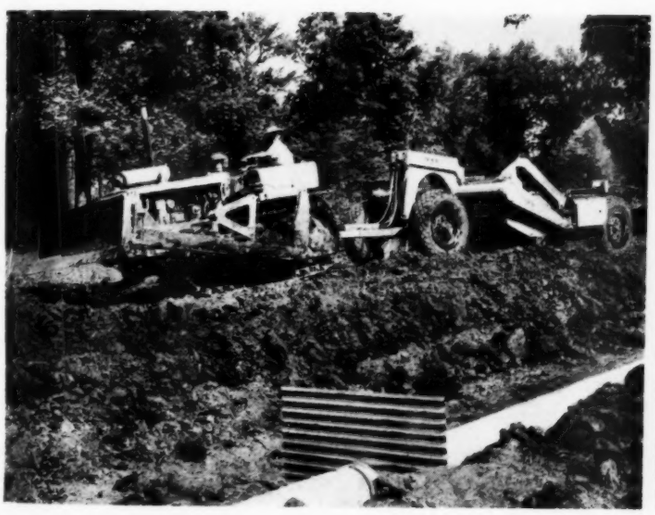
Transportation of materials on farms has been considered from a mechanisation standpoint as largely the horizontal movement of machines, products and materials. Vertical transportation on farms is coming into its own. Our boyhood recollections of vertical transportation on farms was limited largely to 'strong backs' and ropes and pulleys. In this modern mechanised farming period the so-called 'strong backs' are more difficult to find and they are not as willing as they used to be. The farm machine that will lift many kinds of materials vertically is being demanded in increasing numbers.

Bulldozers. Fig. 2 shows a bulldozer being used to build a stock watering pond in western Texas. Many bulldozers are now being used by farmers to build ponds to provide adequate water for livestock and irrigation and to control run-off as part of soil and water conservation programmes. Bulldozers are most efficient when heavy materials are pushed distances not over 200 ft. In addition to building ponds, the bulldozer has many other uses on farms, such as levelling, making and cleaning small ditches, removing trees and brush from fields or fence lines, concentrating manure for loading, making and servicing farm roads, filling gullies, moving large boulders and removing snow.

Ditchers. There is an increasing demand for machines to build and service farm drainage and irrigation ditches. Fig. 3 shows a hydraulically-controlled machine used to build and service ditches of rather large cross-section. This machine is equipped with a hydraulic pump powered by a separate engine. However, when the tractor can be operated near the ditching machine, the hydraulic pump can be located on the tractor.

Fig. 1.—Hydraulically-controlled loader being used to load manure

Fig. 2.—(*Left*) **A bulldozer is used in building a stock tank in western Texas.** **Fig. 3.**—**A hydraulically-controlled machine for ditching** (*right*)



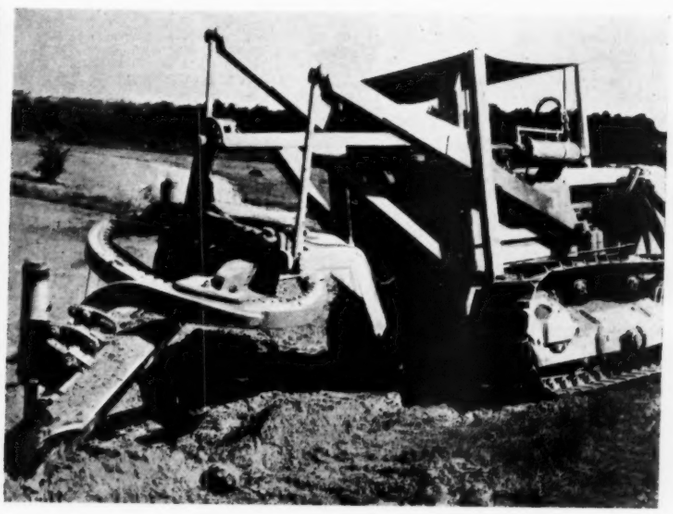
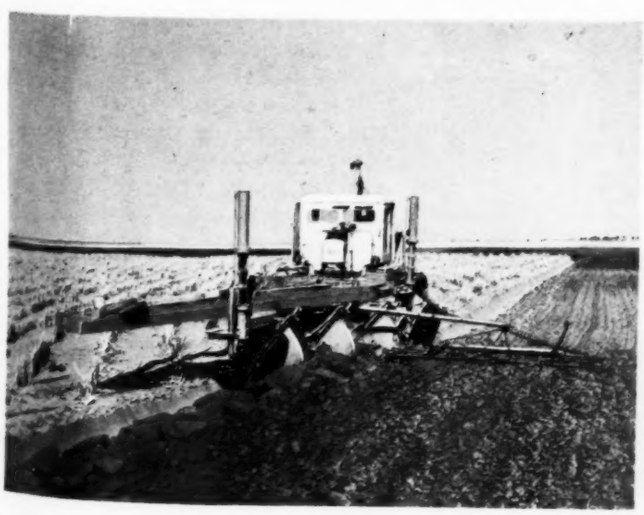
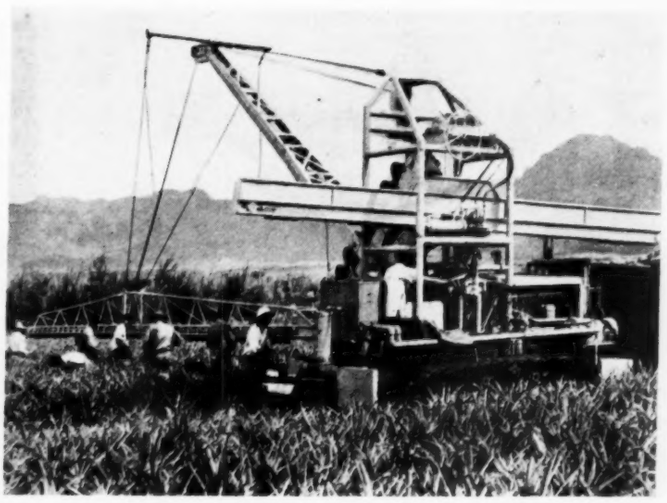


Fig. 4.—(*Left*) **a tractor with a scraper and bulldozer building a dam for a farm pond.** **Fig. 5.**—(*Right*) **Hydraulically-controlled rear-mounted blade.** **Fig. 6.**—(*Below, left*) **Large disc plough and side harrow breaking ground 20 in. deep.** **Fig. 7.**—**Pineapple picking machine at work in Hawaii** (*below, right*)





Scrapers. The tractor in Fig. 4, equipped with an angling blade bulldozer and pulling a hydraulically-controlled scraper, is being used in central Illinois to build a dam for a farm pond which is part of a soil erosion control project. Hydraulic scrapers, especially for the smaller track-type tractors, are being used by farmers not only for pond building, but also ditching and levelling. Irrigating in the U.S.A. used to be confined to western areas with low annual rainfall, but today thousands of acres east of the Rocky Mountains are being prepared for irrigating, especially by flooding and furrows. Where land is to be irrigated by furrows or flooding, high spots should be removed and low spots filled. Hydraulically-controlled scrapers and levellers are used in large numbers for such work.

Tractor-mounted terracer. The hydraulically-controlled rear-mounted blade shown in Fig. 5 is being used for terracing in Missouri. This one-man unit is equipped with a large rear blade that can be adjusted by the operator for angle and depth of cut, and the blade can be set crossways to drift material.

Other special heavy-duty and large-capacity agricultural machines. Fig. 6 is a hydraulically-controlled plough with 44-in. diam. discs. It can be equipped with three, four or five discs. The five-disc unit weighs 12,000 lb. This three-disc unit is ploughing 20 in. deep in Texas.

Fig. 7 is a special pineapple harvesting machine being used in the Hawaiian Islands. This machine is equipped with two hydraulic pumps to control the crane and conveyor.

Each of the machines shown in Figs. 1 to 7 has one or more hydraulic pumps and jacks and, as already stated, the jacks are fixed on the machines and are, therefore, not standard for interchangeability between machines. A large percentage of the machines with non-interchangeable hydraulic jacks are used on or with the larger track-type tractors.

Machines with interchangeable jacks

The third classification of hydraulic power as applied to track-type tractors involves jacks that are interchangeable between two or more machines. These involve hydraulic applications where the jacks are built to the A.S.A.E.-S.A.E. standard. This standard was adopted in March 1949 by the American Society of Agricultural Engineers and covers the application of hydraulic remote controls to farm tractors and trailing-type farm implements. The standard is limited to farm tractors up to and including 35 d.b.h.p. maximum. However, considerable progress has been made to develop a similar standard for farm tractors with more than 35 d.b.h.p.

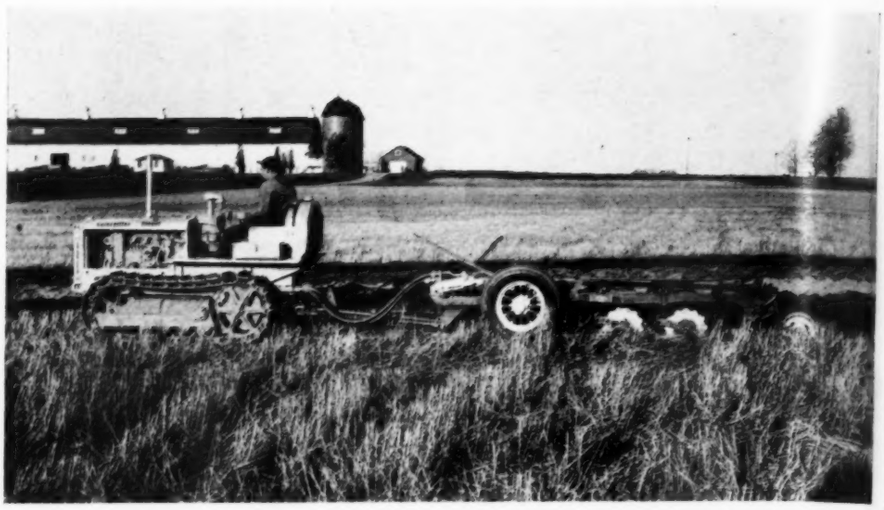


Fig. 8.—Tractor equipped with hydraulic control pulling a mould board plough

The interest in hydraulic controls on farm tractors was certainly evident by the number of machines shown at Corn Belt State Fairs. All the hydraulic controls exhibited on farm tractors and implements did not involve the use of interchangeable jacks, but the trend to adopt the A.S.A.E.-S.A.E. standard was very evident.

It is impossible to tell now to what extent interchangeable jacks will be used on trailing-type farm implements. However, some of the more important applications will be discussed under the following headings:

Mouldboard, disc and one-way stubble ploughs. The hydraulic control shown on the four-bottom mouldboard ploughs in Fig. 8 is built to the A.S.A.E.-S.A.E. standard. If the hydraulic controls applied to ploughs have capacity to raise the ploughs out of the ground at the recommended speeds, then such controls will provide sufficient force to control most or all other farm pulled-type machines.

Fig. 9.—A land leveller at work in California

Levellers. Land levellers have been used for years on western irrigated farms. Fig. 9 shows an 8-ft. leveller preparing land for pasture with an overhead irrigation system. This leveller is controlled with a standard hydraulic jack. Levellers are now being used in increasing numbers not only to prepare land to be irrigated, but also to fill shallow depressions that will not permit satisfactory surface water run-off in high rainfall areas.

Tool bars. A hydraulically-controlled direct-connected tool bar is shown in Fig. 10. This is controlled with standard jacks.

Hydraulic motors

The fourth classification of hydraulic power as applied to farm track-type tractors is hydraulic motors.

Hydraulic motors are not being used to any extent to power farm machines. Not many people can name even one farm implement that is powered in whole or part with hydraulic motors. Yet there are a few commercial and experimental machines, such as a mower, a sweet corn snapper, a plough and a spraying unit. Why are not hydraulic motors being used on more farm

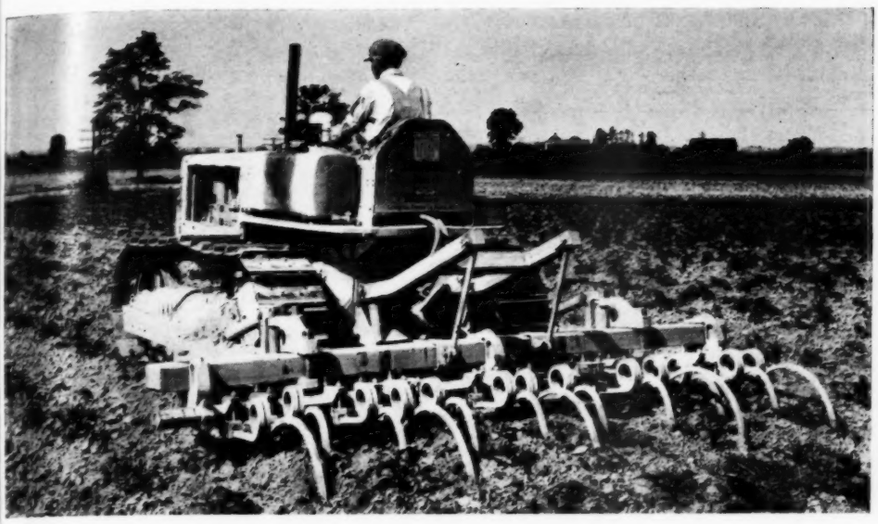


Fig. 10.—Tractor and tool bar equipped with a coil shank cultivator

machines? Engineers give two reasons for this situation, namely, high first cost and low efficiency. Even though high cost and low efficiency have prevented the use of hydraulic motors to power farm implements, the future may present a different picture. There are some who venture the opinion that something can be done about the first cost problem as it applies to farm implements and recommend careful consideration of so-called low efficiency. Perhaps we are permitting our ' horse and buggy ' designs to carry over too much in designing the efficient machines needed today and tomorrow. We began transmitting steam engine and internal combustion engine power by belts. That came before the steam or gas engines were self-propelled. When the self-propelled tractor came along for drawbar work the belt pulley was there, and it was important. Then came power transmission by power take-off —eventually a standard power take-off with 536 r.p.m. While the demand for transmitting farm tractor power by belts has decreased, the use of power take-off driven machines has increased. Transmitting the tractor engine power to operate the various moving parts of a farm implement may involve the use of many shafts, bearings, gears, clutches, universal joints, chains and belts, all of which cost money and result in power losses. Sometimes the cumulative power losses are rather high. When one considers that a 2,000-r.p.m. engine requires a transmission to transmit power to a power take-off shaft at 536 r.p.m., and then another transmission to provide 2,000-r.p.m. rotating parts on a farm implement, it might be well to compare the resulting cost and efficiency factors with hydraulic motors. One rather important point concerning the use of hydraulic motors to power farm implements is that the hoses to connect the hydraulic pump on a tractor to a hydraulic motor on a farm implement allow a degree of flexibility of application not now found in conventional methods used to power farm implements.

Convenience of hydraulic controls

Let us now consider how hydraulic controls on farm implements are more convenient than conventional controls. In the first place, hydraulic controls conserve human energy. The energy required to operate a ' finger tip ' hydraulic valve is nothing compared to the result when a hydraulic pump delivering 35 g.p.m. at 1,000 p.s.i. moves a piston 8 in. in a 5-in. diam. jack. Any system of hand levers or wheel lifts would require more human energy to adjust a farm implement than that merely to operate the ' finger tip ' valve that permits a hydraulic control to raise, lower or otherwise adjust a farm implement. Human energy is expensive; consequently it is economical to use it when and where it will produce the greatest benefit.

The second important convenience of hydraulic farm implement controls is associated with two-way pressure. A double-acting jack not only provides a force to lift a bulldozer, plough or loader, but it also provides an opposite force to cause implements to function satisfactorily when they would not do so with hand or wheel controls. A third convenience results with the use of multiple controls. Some farm implements cannot be controlled with one jack, therefore a multiple valve will permit using two or more jacks.

Operator comfort. A fourth convenience may be classed as operator comfort. It was not many years ago when a farmer riding a spike tooth harrow cart was considered lazy—he was not a real ' he-man ' if he resorted to riding instead of walking. Today tractor operator comfort is being given special attention. Canopies, cabs, hoods, etc., are used to protect the operator from extremes of high and low temperatures, rain and snow, dust and noises. When the tractor operator can control farm implements with ' finger tip ' hydraulic controls within easy reach, he is given a real comfort feature.

Fast and slow fractional implement adjustments. Fast and slow fractional implement adjustment is the fifth convenience resulting from the use of hydraulic implement controls. When a plough begins to ' sink out of sight ' in a soft spot, it is desirable to raise the plough quickly without stopping or stalling the tractor engine. Hydraulic controls permit the operator to do just that. When a combine header is set too high, it misses the lower pods on soya bean plants, and if too low the cutter bar will dig into the ground. Fractional adjustments of a header bar are often needed to obtain satisfactory results.

Operator safety. A sixth convenience of hydraulic implement controls pertains to operator safety.

When it is necessary for an operator to reach for levers on an implement or stop and get off the tractor to adjust implements, the possibilities of accidents are manifold as compared to adjusting a farm implement by merely moving a conveniently located lever. Repetitive hand adjustments that waste time and energy cause operators to become careless, especially when tempers are on edge. A slight delay in operating a hand lever on a mower, or even pulling a rope for a wheel lift, may result in a clogged machine that necessitates hand cleaning. All such hand cleaning operations are promoters of accidents.

More work done per working hour. The seventh convenience covers less machine ' down time.' One does not combine when the grain is wet with dew or bale hay in the field when it rains. In other words, timeliness is extremely important for many farming operations. The uncontrollable lag in adjusting machines by levers or wheel lifts can result in a stalled machine that may require many minutes to straighten out. Those lost minutes can be costly—hydraulic implement controls can ensure more continuous operation of farm implements when it is most timely that they be working.

The eighth convenience of hydraulically-controlled farm implements promotes quality of work done. An operator desires to leave a sod waterway when ploughing a field. That means the plough must be

raised and lowered at the right time, otherwise the waterway will be too wide or too narrow in places. If the hand or wheel lifting arrangement does not operate smoothly, perhaps the operator will be inclined to get careless or even give up attempting to leave a grass waterway. If the hand lever control is too difficult to operate, perhaps the operator will not lower the cutter when crossing a low spot, such as a dead furrow, thereby resulting in losses. The average human being cannot be subjected to many inconveniences without resorting to short cuts, and these often result in not doing a job the way he knows it should be done. Therefore, because of the ease and dependability of using hydraulic controls, the operator is encouraged to do what he knows he should do. In other words, he is encouraged to strive for quality of work done.

Conclusion

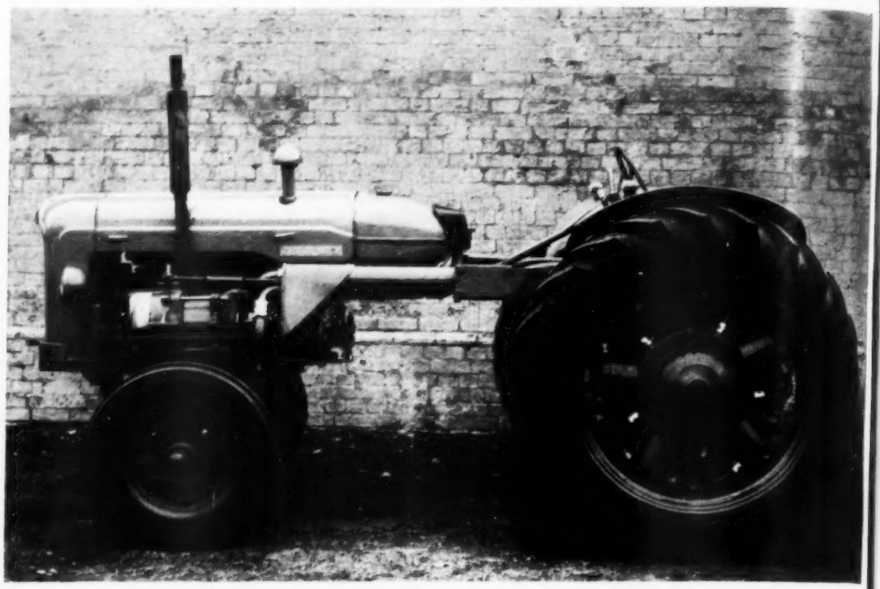
The usefulness and convenience of hydraulic power when farming with track-type tractors has now been given consideration, so what can be said about the profit to be derived by using it? No doubt it would be interesting if the profit could be calculated in dollars. But the use of data and formulae to calculate dollar returns would be difficult for any hypothetical farm unit and could only be interpreted as an average.

The importance of farm safety is generally recognised and an attempt has already been made to show how hydraulic controls make tractor operators less subject to accidents. Not many years ago the number of workers per farm and of workers available for hire was substantially greater than today and employer's liability was not a risk factor. A farm accident today may jeopardise a farming programme, with resulting increased production costs and losses that would not have occurred in past years when the number of available farm workers was greater.

An attempt has been made to indicate how hydraulic controls can conserve human energy. Fatigue promotes interruptions in productive operations. Unnecessary rest periods or short working hours can be very costly, especially when timeliness is so important. A few minutes of needless lost time before a rain can result in serious losses.

Ease of operating a machine may mean the difference between conforming to a recommended practice and following a course of least resistance. The quick control of a farm implement may prevent overloading or overstressing certain parts. Obviously overloading and overstressing increase wear and the number of damaged or broken parts.

This consideration of the profit to be derived by using hydraulic controls can be summarised in a broad way by stating that the nearer machine operations can be continuous at recommended speeds the lower will be the cost per unit of production.



N.I.A.E. hydraulically-propelled tractor. This view shows the remarkable amount of space available for mounted implements

A Hydraulically-Propelled Tractor

As a pendent to the foregoing article on the use of hydraulic equipment for tractors, the following note regarding a hydraulically-propelled tractor devised and shown by the British National Institute of Agricultural Engineering is of interest.

The first British experimental tractor using hydraulic transmission was shown to the public during the open days at the National Institute of Agricultural Engineering, Wrest Park, Silsoe, Bedfordshire, on May 26 and 27, 1954.

The construction of the tractor was completed only two or three weeks before the demonstration, it had not been tested or, in fact, put under load at all, and it is envisaged that a considerable amount of experimental and development work remains to be done. The tractor is, however, mobile and was shown for the purpose of stimulating interest in and consideration of a method of driving which offers several advantages:

(1) The conventional clutch control and gear lever are replaced by a single lever giving a stepless speed control from full speed forward to full speed in reverse. Thus the operator can obtain exactly the speed he wants and can, of course, change speed while on the move.

(2) The arrangement of a hydraulic pump adjacent to the power unit and hydraulic motors built inside the driving wheels provides considerably more space for mounting implements and, in fact, gives the designer an altogether freer hand to consider agricultural requirements unrestricted by mechanical limitations.

(3) The method of control is such that damage by careless or unskilled operators is less likely than with a conventional clutch and gear transmission. No damage is possible, for example, analogous to that caused by 'riding' a clutch.

It remains to be seen whether the system is technically satisfactory and economically practicable.

To Authors and Readers

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Trials with Systemic Insecticides on Hops

G. A. EMERY, M.A.

The Murphy Chemical Co. Ltd.

This paper contains an account of some recent experiments with five systemic insecticides for the control of injurious insects (aphids and red spider) on hops in Britain.

DURING the season 1953 experiments were carried out to compare the efficiency of different types of systemic insecticides for the control of hop damson aphis (*Phorodon humuli*) or 'blight' on hops. For this purpose the co-operation of four growers in Kent and four in the Worcester-Hereford area was obtained.

Varieties employed and mode of application

Five varieties of hop were used, *viz.* Fuggle, Cobb, Bullion, Mathon and OR55. To ensure that conditions should be, as far as possible, the same for each site, a special 60-gal. low-pressure spraying machine was used which could be transported in an Austin A70 truck. This machine was used for all applications of spray, except on two sites where an autoblast was employed for the third application.

The first application on all plots was made during the period June 3 to 10, when the bines were about 6 ft. high, using 100 gal. of spray liquid per acre. Subsequent treatments were given to each plot as and when required, using 200 gal. per acre. In all cases a fine mist spray was employed, giving thorough coverage of the leaves without run-off. Terra-Sytam was applied to the soil at 25 gal. per acre.

Lay out of the experiments

Individual plots were of eight or 10 rows and observations were carried out only on the two middle rows to avoid spray drift effects. A minimum of three guard rows was found more than adequate.

An entomologist was stationed in each area to make continuous observations from two weeks before spraying to the time of picking and to carry out counts twice a week on each site. For purposes of assessment 25 hills, evenly spaced throughout the length of the plots, were labelled and detailed observations made on them. The infestation on each hill was graded separately for 'fly' (winged aphides), 'nits' (nymphs) and 'cows' (stem mothers). The system of grading employed was to give zero for total absence of any particular stage, one for one or only a few scattered individuals, two for a light infestation and three for a moderate to heavy infestation. For purposes of evaluation only the counts of 'cows' was utilised, the counts of the other forms being made merely to indicate whether a potential infection was present or not. Thus, as long as 'nits' were present and 'cows' absent, it was clear that the insecticide was still taking effect.

Materials tested

Schradan.—(1) Sytam, a commercial preparation containing 45% schradan (bisdimethylamino phosphonous anhydride) with other related dimethylamides and a wetting agent. (2) 70% pure, redistilled schradan and a wetting agent.

Demeton.—(3) Systox, a commercial preparation containing 50% demeton together with a wetting agent.

'Tris' (R_3PO).—(4) 80% pure, redistilled R_3PO and a wetting agent.

Terra-Sytam.—(5) A commercial preparation based on dimefox (bisdimethylamino fluorophosphine oxide) applied as a soil dressing in 100 ml. of water direct to the crown of each hill.

(Demeton is the suggested common name for O,O-diethyl O-ethylmercaptoethyl thiophosphate; R_3PO or 'Tris' signifies trisdimethylaminophosphine oxide.

The schradan materials were each used at two rates, *viz.* 0.075% (12 fl. oz. per 100 gal.) and 0.037% (6 fl. oz. per 100 gal.), with the addition of extra wetting agent in the latter case to bring it up to that in the former.

Systox was used at three rates, *viz.* 0.05% (8 fl. oz. per 100 gal.), 0.025% (4 fl. oz. per 100 gal.) and 0.0125% (2 fl. oz. per 100 gal.), together with extra wetting agent.

The 'Tris' preparation was used at 0.1% (16 fl. oz. per 100 gal.).

Terra-Sytam was used in the main plots at 2.5%, allowing 100 ml. to each hill, and in further plots 1.5%, 1.0% and 0.5%, all applications being of 100 ml. to the crown of the hill.

Results

The average infestation from each day's observation on each plot was obtained by calculating the total 'score' for the 25 hills and dividing by 25. This average figure was then plotted against the time since the application of the insecticide.

Within 48 hours after the first application it was found that 'cows' were absent from all plots except those treated with Terra-Sytam. On the Terra-Sytam plots the decrease was slower and there was not complete elimination for 10 days. During this period it was possible to trace the course of the insecticide up the bine, as the aphides died on successive leaves. Thereafter the Terra-Sytam plots remained clean to the time of picking, except at the lowest concentration. At two sites single hills showed abnormal results. In each case this was found to be due to a bine, rooted about a foot away from the main hill, having been trained up with the others; it was on this bine that aphides survived to a slight extent.

On the plots treated with Sytam at the full rate and pure schradan at the full rate no aphides developed for 30 days. After this, or within the following six days, there was a definite cessation of insecticidal effect. But after an initial rise the infestation maintained a very low level for a further period of about 15 days, due to the fact that the very high population of predators (notably Coccinelids and Anthocorids) was able to hold the small number of aphides in check. At no time was any appreciable destruction of predators noticed from treatments with schradan-containing materials.

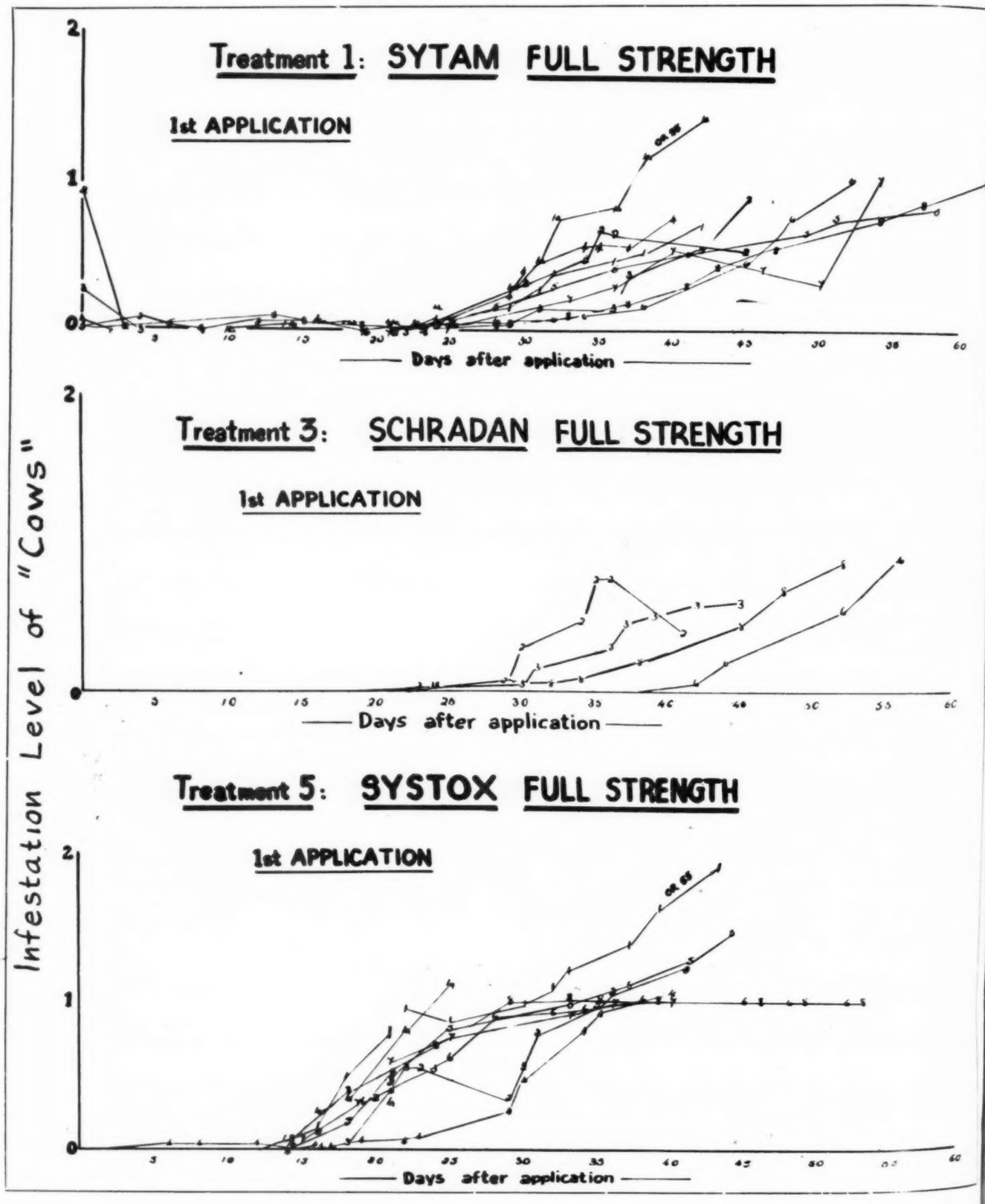
On plots treated with the two schradan materials at half-rate similar results were observed, but the period of full protection was reduced to about 21 days and the subsequent rise of infestation sharper.

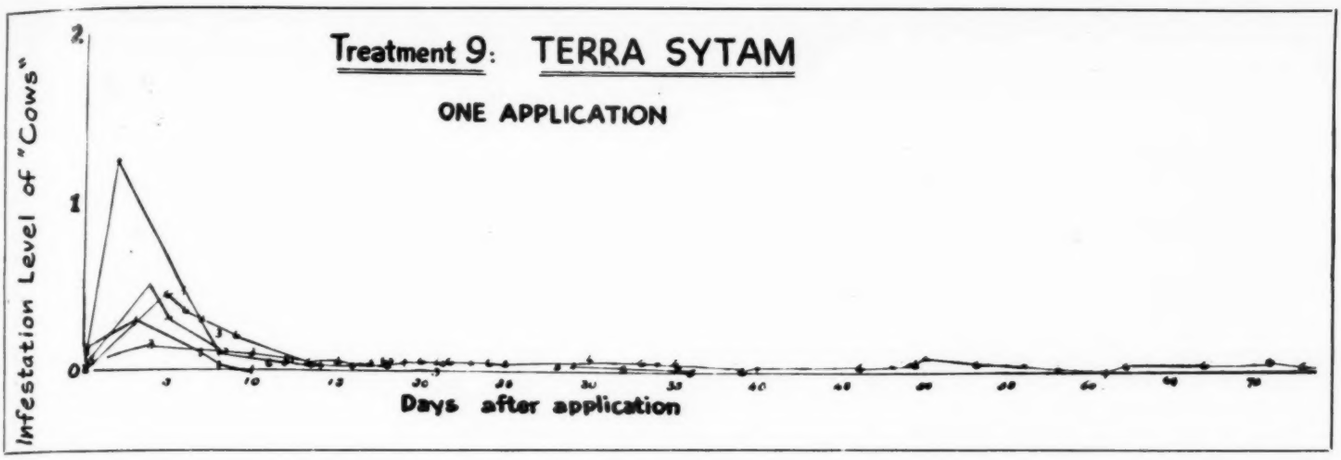
With demeton at the higher rates the period of complete protection was only 15 days; after that the rise in population was much sharper than in the case of the schradan plots. This may be partly accounted for by the more abrupt breakdown of the insecticide, but is more probably due to the very considerable destruction of predators observed after spraying. After a time predators returned from neighbouring plots and effected some degree of control.

The effect of demeton at the lowest rate was very poor, being little, if any, better than that of parathion. There was almost total destruction of predators and the insecticidal effect did not persist for more

than 10 days; thereafter rise in population of ' cows ' was very rapid.

The results with ' Tris ' were difficult to interpret. This was known to be a less efficient insecticide, but was included in the trials because it was thought that its non-poisonous nature might compensate for lower efficiency. At two sites some degree of control was obtained for about 15 days and on a third site for 12 days, but on the fourth site there was little evidence of control. However, on this site the variety was OR55, which proved less amenable to all systemic insecticides; on the third site the variety was Cobb, which is also ex-





ceptional, but not to the same degree as OR55.

Results of second treatment

The most noticeable fact was that none of the materials produced the rapid effect observed from the first application. With schradan five to 10 days were required before the aphis populations reached zero, while with demeton and R_3PO results were very variable, on some sites hardly any reduction being observed at all.

Schradan materials, used at the full rate, after a delay of five to 10 days reduced the population to zero, and as by then no further fly was coming in the hops remained clean up to picking. At the half strength on six sites the population was reduced to zero in seven to 15 days and the hops remained clean thereafter. On the varieties OR55 and Cobb, however, after a sharp fall the population mounted rapidly again, and a third application had to be given which brought the count to zero in 10 to 12 days.

With demeton at the full rate, on two sites the count reached zero in 10 days; on two there was a rapid fall in the first two days, but then a very steep rise and a third application had to be given after 15 days; on two other sites there was little effect and these also were retreated after 12 and 15 days, when the third application brought the infestation to zero in seven days.

Results with demeton at reduced rates were most unsatisfactory. After a slight fall in the first two days, infestation increased at an alarming rate and these plots were then sprayed with Sytam to safeguard the crop.

Results of third treatment

As indicated above, a third treatment had to be given to the plots on which a reduced concentration of schradan, demeton or 'Tris' had been used. In every such case the population was reduced to zero and the hops remained commercially clean up to the time of picking, although on one site there was an indication of slight build up on the demeton plot.

The reason why this third application was effective in keeping the infestation down for a further nine weeks (despite the indication that, even in the case of schradan, duration of full insecticidal effect was only just over four weeks and for the others very much less) was undoubtedly the fact that there was no influx of aphis on to the sites after July 17. The destruction of those individuals actually present at the time of the third application was therefore all that was required to prevent further build up.

Red spider control

Although the trials were laid down solely to compare the efficiency of the different systemic insecticides in the control of aphis, it became obvious, from two sites where red spider (*Tetranychus telarius*) was present, that there was a difference in efficiency of the four insecticides in the control of this pest. The hops treated with Terra Sytam were completely free from this pest, while infestation was low on the schradan-treated plots, medium on the demeton plots and high on the 'Tris' plots. A further trial was therefore made later in the season to ascertain the efficiency of Terra-Sytam at different rates in the destruction of an existing infestation. For this purpose a piece of badly infested hops was chosen and Terra-Sytam applied at the original rate used in the main experiment and at two-thirds, two-fifths and one-fifth of this rate. The applications were made in the third week in July and the hops were picked at the beginning of the third week in September. At all rates red spider was destroyed after three to five days, and at the two highest rates the plants were still clean at the time of picking, despite the fact that they were surrounded by heavily infested hops. At the third strength (two-fifths rate) a few individual mites were found at the time of picking, while at the lowest strength (one-fifth rate) infestation was just beginning to build up, the spider having gone through one generation.

General conclusions

The trials showed that pure schradan (70%) or the proprietary brand Sytam, used at the rate of 0.075%, was fully effective in controlling aphis and in giving adequate commercial control of red spider when two applications were given. The first was given early in June, when the hops were about 6 ft. high, using 100 gal. of spray liquid per acre, and the second some six to seven weeks later at 200 gal. per acre. The sprays were applied to give adequate wetting of all leaf surfaces. A number of other gardens were visited, whence reports had been received that schradan preparations had given inadequate control. In all cases this was found to be due to inefficiency in application; generally, the growers in question had sprayed only through every other alley, so that the hop plants were efficiently sprayed on one side only. When the quantity of schradan applied was reduced to half there was a marked difference in control, particularly in the duration of the protection given.

When the number of predators present is too low to keep the infestation down, after the effect of the first application has worn off, or where a heavy influx of winged aphis occurs during this period, it might be an advantage to give three applications of schradan. The second should be timed three or four weeks after the first. Under such conditions the duration of protection given by schradan at half, or some intermediate, concentration might be adequate.

Demeton proved disappointing against both aphis and red spider on hops. Aphis could not be adequately controlled with less than three applications at the rate of 0.05% and under conditions of high influx during the middle of the season four or

more applications might be required. Demeton caused very considerable destruction of predators, with consequent very rapid build up in the infestation of red spider after the effects of the insecticide were over; this occurred some 14 days after application. Contrary to expectations, demeton did not give a rapid control of aphis when applied in the middle of or late in the season.

The non-poisonous systemic insecticide 'Tris' gave much poorer control than the other three insecticides, despite the fact that it was applied at a much higher concentration. Nevertheless, it might be of interest where it is undesirable to employ an insecticide of a high mammalian toxicity. Three applications would always be required, with the possibility of a fourth in certain circumstances. It was apparent that there was a very different response in different varieties of hop.

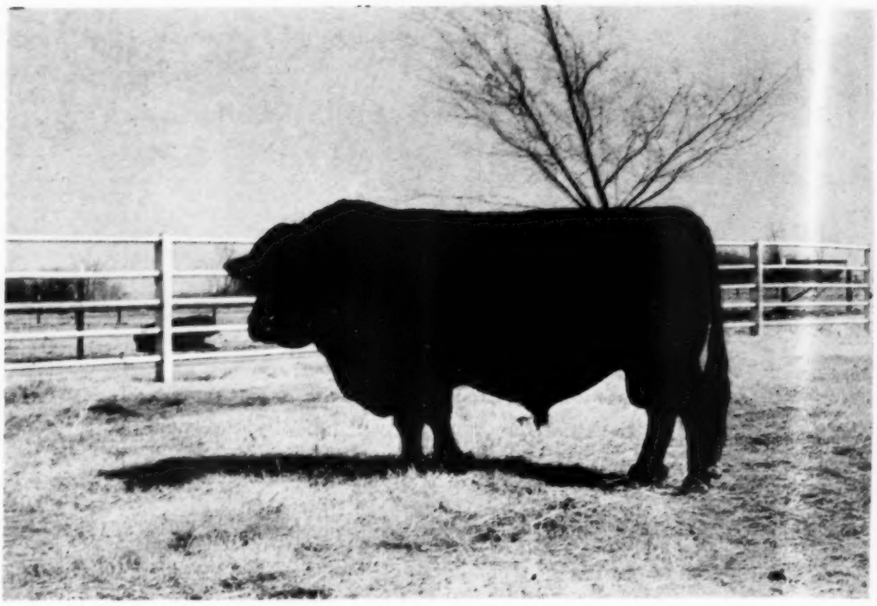
The most outstanding material tried was Terra-Sytam, applied in a small quantity of water to the crown of the hop hills. With this insecticide complete control of both aphis and red spider was obtained right through to picking, from a single application at the beginning of June when the hops were some 6 ft. high. The use of this insecticide completely eliminates the hazards due to spray drift, which can be serious when the hop plantation lies next to pasture or a main road.

Samples of hops were taken at the time of picking and dried normally for analysis. In the case of Terra-Sytam a sample was also submitted to a brewing test for observation on the effect, if any on brewing qualities, as this material had not previously been applied to hops. No effect could be detected on either beer stability or flavour. In no case was there a serious residue of insecticide left in the hops.

Since these trials were carried out further trials have been made with Terra-Sytam in Australia on the control of red spider (*Tetranychus telarius*), application being made at the 'burr' stage. The bines remained clear until after picking, while there was a moderately severe infestation on the control plots. Three weeks after picking the bines treated with Terra-Sytam were still green, while the rest were completely brown.

Acknowledgments

Thanks are due to Mr. D. Hunnam and Mr. J. C. Hall, who assisted with the first applications, and to Mr. D. H. Jones and Mr. C. R. Dash, who carried out the daily observations, also to the directors of The Murphy Chemical Co. Ltd. for permission to publish this report.



Angus Valley Farms

During a recent visit to the U.S.A. Mr. Leonard Hill, the Chairman of Leonard Hill Ltd. had occasion to visit the Angus Valley Farms at Tulsa, Oklahoma.

This enterprise, which was inaugurated in 1939, now occupies some 1,680 acres and is mainly devoted to the raising of pedigree cattle of the Aberdeen Angus breed. The buildings and equipment of the farms are of the most modern description. The farms are stated to carry a herd of approximately 350 breeding cows and over 28 registered bulls.

The undertaking runs its own sales ring, while its produce has found its way into farms in almost all parts of the United States, where they have achieved a high reputation and command very high prices. We reproduce a photograph taken by Mr. Leonard Hill of one of the bulls.

National Institute of Agricultural Botany Meeting

The quarterly meeting of the council of the National Institute of Agricultural Botany was held at the end of April. The council welcomed to their first meeting Prof. Darlington, who has taken Prof. Osborne's place as the representative of Oxford University, and Mr. R. J. E. Taylor, who has taken Mr. B. W. Phillips's place as one of the representatives of the Ministry of Agriculture and Fisheries.

Difficulties sometimes arise when new *elite* stocks are introduced as alternatives or successors to an original variety which they closely resemble. The council decided to ask the cereal synonym committee to consider this problem, but accepted meanwhile an interim recommendation from the cereal trials advisory committee to accept Carlsberg II, Fylgia II and Primus II on the recommended lists beside Carlsberg, Fylgia and Primus. The decision will be reviewed when more information is available. The position of these varieties is, of course, quite different from that of such pairs as Sun I and Sun II, or Victor and Victor II, when the new variety is of an entirely different pedigree to the first.

The council considered interim reports of their root trials and potato trials advisory committees and noted that a revised farmers' leaflet on sugar beet and a farmers' leaflet incorporating a recommended list of potatoes were in preparation and would be published before the autumn.

The council also considered arrangements for the annual fellows' day at Cambridge on July 16 and were glad to hear that Sir John Russell had agreed to address the annual meeting.

Hungary's Rice Combine

Hungarian engineers are working on two prototypes of a caterpillar-tracked rice combine harvester. These will be tried out during this year's harvest and on the basis of experience gained they will go into general production next year. It is claimed they will each harvest, thresh and clean 20 tons of rice on 14 acres a day.

The Present Position and Outlook of the Cocoa Industry

In this article an account is given of the present world demand for cocoa which is increasing at a time when there is almost stationary production. The market position in this regard has been abstracted from the Cocoa Market Report—No. 84 of Gill and Duffus, Ltd.

The London market

THE price of Accra cocoa was at the highest level then recorded at the end of February at 467s. 6d. per cwt. c.i.f. Early in March a limited amount of business was done in the market at 422s. 6d., but the market reacted quickly. From this point prices rose steadily in the face of a growing and continuing demand. At this stage the Marketing Board were sellers at 440s. per cwt. c.i.f. U.K. The boards then steadily adjusted their price upward to 490s. per cwt. first for April-June shipment, and then May-July shipment. Prices reacted a little in the second-hand market in mid-April, but the Marketing Board held their price firmly. Early in May the market became very strong and the price of Accra from the Marketing Boards and in the second-hand market reached 495s. per cwt.

Developments in the U.K.

Consumption of chocolate and sugar confectionery in the United Kingdom continues at a high level, although the trade is becoming more competitive and the consumers more selective in their buying habits. The total quantity entering distribution during March was approximately 9.3 oz. per head per week compared with 8.8 oz. in the previous month and 7.9 oz. in January. The trade is tending to revert to the pre-war seasonal pattern and no definite conclusions can yet be drawn regarding the average level of consumption during the current calendar year.

U.S. developments

The United States Department of Commerce's figures of manufacturers' sales of confectionery and competitive chocolate products in January 1954 were 2% below January of the previous year. During the month of February sales were 5% below February 1953. The trend was reversed in March according to preliminary information and the dollar sales value increased by 5% over the previous season and by 3% in poundage.

The outlook for cocoa bean consumption in the United States is obscure. On the one hand, some of the leading manufacturers have turned their faces against the use of compound coatings. Whilst the prices for genuine chocolate products have been increased, and strict economy exercised in the usage of cocoa beans, the standards of their products remain unchanged. On the other hand, a substantial number of manufacturers are using various types of confectioners' coatings or imitation chocolate.

Developments in other cocoa consuming countries

The Amsterdam Cocoa Futures markets reopened on April 5. The contracts are 5,000 kilos each.

French manufacturers collectively bought several thousand tons of British West African cocoa late in March at 480s. per 50 kilos. France has found it necessary to supplement supplies available from French West African territories by buying British West African and Brazilian cocoa to meet domestic requirements.

In common with other countries, Switzerland announced an increase in retail prices of chocolate by 5% to 10% as from April 1 last. During February Swiss chocolate exports were worth 1.2 million francs compared with 1.3 million francs in February 1953. The value of exports in March remained unchanged from the February level at 1.2 million francs, but did not reach the March 1953 total of 1.5 millions.

Brazil is concluding a number of trade agreements with Eastern Europe. East Germany proposes to import Brazilian cocoa beans in return for industrial equipment. Hungary is also to import cocoa beans against the supply of machinery. A Yugoslav trade mission is expected in Brazil shortly, to be followed by one from Rumania.

Imports of cocoa beans into Canada increased by 14% in 1953. In that year 32,725,800 lb. of beans were imported, against 28,627,800 in 1952 and 26,024,200 in 1951.

Developments in cocoa producing countries

During February 761,755 trees were cut down in the Gold Coast and during March 703,949. The figure has averaged approximately 700,000 during recent months and the total has now reached 26,833,948. Work of survey, re-survey and cutting out of diseased trees has continued steadily, the number of trained staff available only limiting progress. Heavy early rains have resulted in flushes of new growth on most farms, although marginal areas continue to suffer from drought conditions. The weather has been generally favourable for plant growth and cocoa is rapidly recovering from the effects of the dry season.

A detailed study has been made of yield records of Amazonian varieties—bean size and quality assessments—with a view to releasing a number of types for distribution to selected farms during the coming planting season. It is understood that the Minister of Agriculture has approved the issue of a number of selected types. The amount of planting material available during the present rainy season will not be large, but considerable supplies will be produced during the next main crop. Applications are now being received for Amelonado seedlings from the Department of Agriculture nurseries. There are 2 million seedlings available in the Eastern Region and smaller numbers in other areas.

The Gold Coast Minister of Agriculture, in reply to a Parliamentary question, has pointed out that figures of output have remained roughly stationary on the average for some years. He went on to say that output during the next, say, 10, years depends largely on bringing the swollen shoot disease under control as rapidly as possible and replacing trees lost on account of the disease wherever conditions are suitable for replanting. As regards replanting, surveys already carried out indicate that the acreage of young cocoa trees planted to date will be more than sufficient to offset declining yields from farms of old cocoa trees and from farms established in unsuitable conditions. He went on to say, however, that a proportion of the new cocoa farms have undoubtedly been made in marginal conditions of soil and climate, and also that capsid damage is severe in many areas.

Looking at the situation as a whole, it may be anticipated with some confidence that production will at least maintain its present level during the next 10 years and that it may gradually increase during that period.

The breakdown of Gold Coast production during the 1953-54 main crop season

has become available as follows:

	Season 1952-53	*Season* 1953-54
Ashanti	117,979	103,771
Western Region ..	38.155	37,615
Eastern Region ..	59,772	42,688
Trans-Volta ..	27,479	21,719
Total ..	243,385	205,793

In the Western Region of Nigeria, where most of the cocoa is grown, a campaign is being launched to encourage farmers to spray against black pod disease in suitable areas. It is hoped to deal with 24,000 acres in 1954, but to cover a very much larger area in 1955.

The outlook for cocoa

The unbalance in current world cocoa production and consumption at the level prevailing during the calendar year 1953 is now too well known to need much elaboration. Supplies of cocoa produced during the cocoa year October 1, 1953 to September 30, 1954 (including the Brazilian Temporao on the basis of present forecasts) are likely to be of the order of 720,000 long tons. The other crops are known with a fair degree of accuracy at this stage in the cocoa year.

'Absorption,' 'disappearance' or 'grindings' of cocoa beans throughout the calendar year 1953 was of the order of 809,000 long tons—an all-time record. This figure represents the quantity of cocoa beans taken into production from all stocks, and is usually referred to as ' grindings ' in the United States. These figures are known fairly accurately in most countries and are likely to be closely in accordance with the facts. They reflect real consumption, although to arrive at this figure changes in pipeline stocks of cocoa products would have to be taken into account.

Data on world stocks of cocoa beans indicates that these have been steadily depleted in recent years and they no longer provide a cushion against a decline in world production, such as has occurred this season. The gap between the 1953 level of consumption and the 1954 level of cocoa bean supplies is, therefore, seen to be of the order of 90,000 tons. It is perhaps not surprising that cocoa beans have reached a record price level of about £500 per long ton (62½ U.S. cents per lb.).

So far in the calendar year 1954 consumer prices of cocoa products have only slightly reflected the great increase in the cost of raw cocoa. Consequently, as yet there has been no dramatic drop in the level of consumption of cocoa products; indeed, it would be difficult to visualise under present world economic conditions that such a decline could take place unless under the stimulus of a substantial increase in consumer prices for cocoa products. As manufacturers absorb their lower-priced stocks, which they have averaged with recent purchases in order to keep consumer prices relatively stable, the end-product prices must increase. Although manufacturers have economised in the use of cocoa beans wherever possible, changing the composition of their various lines, nevertheless the saving of cocoa beans in this direction is strictly limited. The equation of demand with available supplies which must come about, therefore, seems likely to be brought into being through the further sharp increases in consumer prices in the second half of 1954 and the first half of 1955.

The centre of interest in the world's producing areas is now switching to Brazil, where the current Temporao crop is reported to be extremely favourable. Nevertheless, a good crop here is probably very largely discounted in the world markets, and over three-quarters is already sold forward. It seems, therefore, that little alleviation to the supply position in the immediate future can be expected.

The long-term trend of the market would, therefore, appear to turn very largely on the size of the next African crops. Reliable information as to their size is only likely to become available rather late in the year. Should these again prove disappointing it would give some support to the view that Gold Coast production is unlikely to increase in the next few years. On the other hand, a good all-round crop in Africa, coupled with good supplies from Latin-America, could do much to restore the present state of unbalance between supply and demand.

Larger Fertiliser Plants?

A possible pattern for technological changes in the fertiliser industry was outlined before the national meeting of the American Institute of Chemical Engineers in Washington. Some members of the industry are already getting ready for these changes. They could involve a shift from the conventional small fertiliser plant of about 50,000 tons annual capacity to an integrated continuous-process plant producing at the rate of several hundred thousand tons per year.

F. A. Retzke, G. F. Sachsel and R. B. Filbert, jun., Battelle Institute, Columbus, Ohio, described many factors which might accelerate the shift to the continuous-process plant. Most important of these were:

First, it is questionable whether the conventional small fertiliser plant will continue to be the most economical unit for meeting the greatly increasing demand for fertilisers. During the last 20 years, the annual consumption of fertilisers in the United States has risen from 5 million to 23 million tons. Over the next 20 years, with an expected population increase of 40 million and with farm acreage expected to remain fairly constant, the need for greater per acre production of food should continue the sharp increase in fertiliser consumption.

Secondly, cost-conscious consumers have focused attention on production cost, analysis and properties of fertilisers. To meet present and future demands, therefore, manufacturers need to produce from the cheapest possible raw materials, by the most flexible process, and at low operating cost. Such production can probably be achieved best through the modern chemical process industry, which has made available new cheap raw materials and a variety of continuous processes adaptable to the fertiliser industry.

Mr. R. B. Filbert, who presented the paper to the chemical engineers, stressed that it was not possible, at this time, to say how extensively continuous-processing might take hold of the fertiliser industry. He said that because of the many assumptions required, nothing short of a detailed study of a particular manufacturer's operations and his regional market can furnish a reliable estimate of the minimum or maximum investment in process improvement that will yield him an attractive return.

Gailey and Roberts Anniversary

Messrs. Gailey and Roberts, one of the United Africa group, this year celebrate the fiftieth anniversary of trading in East Africa. During the 50 years, despite adversities, they have made remarkable progress. There are now 14 branches throughout East Africa and a staff of some 5,500 are employed. Their main interest has been in the importation, sale and servicing of agricultural, building and industrial equipment. Out of the total imports to East Africa in 1951 of £104 million, Gailey and Roberts' turnover amounted to £4,300,000. In every major enterprise in the agricultural development of East Africa Gailey and Roberts have been to the fore.

Anhydrous Ammonia as a Fertiliser

PROBABLY the most important single development in the fertiliser field in the U.S.A. today is the increasing direct application of ammonia, and there is no question as to the future of the direct ammonia application idea in agriculture. This seems to be the general tenor of opinion in the industry. With the past fertiliser year showing an increase in consumption of 15% over the previous year, anhydrous ammonia certainly seems a safe bet for some time to come.

Use spreading

Mississippi and California were the regions in which direct application of ammonia started to develop and they are still leading areas. Louisiana, also a leader, used 26,000 tons of ammonia for direct application last year. That was 40% of the state's total of fertiliser nitrogen. Use is being taken up increasingly in the Midwest. The practice is spreading.

This is strikingly true in the corn and wheat areas, where almost no nitrogen fertiliser previously was used. It is there that the growth now is most rapid. The area concerned is beginning to spread across the Dakotas and into Washington. Knowledge of the benefits of nitrogen application is spreading. Having a nitrogen content of 82%, as compared with, for example, 21% of ammonium sulphate, it has an advantage. As anhydrous ammonia is the cheapest source of nitrogen and provides that element in a readily available form for rapid uptake, it is finding favour with farmers.

Growth of direct application of ammonia has been impressive. The original application through irrigation systems was made by Shell Chemicals on the West Coast in the early thirties. Application directly beneath the soil began in Mississippi, reaching a commercial stage first in 1947. The consumption was about 20,000 tons in 1946, 120,000 tons in the 1950-51 fertiliser year, and more than 230,000 tons in 1952-53. Some well-informed men in the field think that the figures for the past two years are as much as 10% lower than actual consumption. For the current year 300,000 tons would not be surprising. Direct application is being used also in Norway, Sweden, Hawaii, and probably some other countries.

Application of anhydrous ammonia is still the subject of a great deal of experimentation and it appears that much is yet to be learned about effective application. This applies both to placing the material in the soil and also timing. In the western and northern parts of the United States, the nature of the soil makes autumn application practical, while the sandy soil in the East and South calls for spring application.

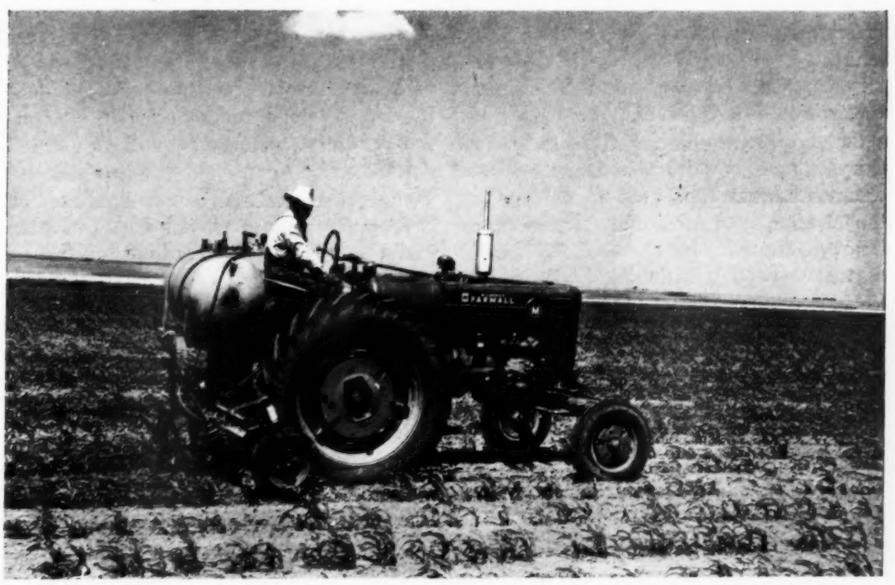
Climate is important

Fall application is best where winters are cold. Nitrification stops when the temperature is below 60° and the ammonia is held until spring. In warmer winter climates there is some loss by leaching of the nitrates formed. There is some unfavourable evidence on fall application. At Mississippi State Agricultural Experiment Station, it has been found unsatisfactory for small grains, while in Indiana, unsatisfactory results came from fall application to wheat. Wet or dry extremes offer physical problems—fall or spring. Some experts suggest that fall application will supply nitrogen to soil micro-organisms allowing them to multiply and give a more desirable decomposition of crop residues. Whatever the time may be, direct application is the method used at present and it seems likely that it is here to stay.

At present there is a trend, in regions where it is practical, to supply the ammonia at the same time and as a part of the usual tillage operations. This is expected to effect economies which will be attractive to the farmer. When applied in the spring, with the crop already in, ammonia is injected between crop rows. Timing is such that the plant receives a high dose of ammonia only after its root system grows out to the middle of the row. Deep application, 4 to 7 in., causes deep rooting and is particularly useful in dry regions to get the roots to grow deeply to reach the water supply. Deep application also has the advantage of less chance of oxidation to the nitrate form which is more readily leached away. Crops can feed on both nitrates and ammonia of course.

One sales approach to encourage the farmer to apply more ammonia to pastures and forage crops—which some believe eventually will prove to be a big market—is ' grow more protein at home.' It has been pointed out that farmers spend much more money on commercial feeds than on fertilisers. In New York State, where 40% of all milk check money goes for mill feeds, farmers in 1952 spent eight times as much there as on fertilisers and lime. The ammonia salesman's contention is that the farmer wouldn't have to buy so much protein if he grew more of it by increased application of nitrogen on farm crops.

There is some rivalry between anhydrous ammonia and mixed fertilisers. Some fertiliser mixers claim that after two or three years of anhydrous ammonia treatment, plants no longer have ability to take up the nitrogen. Furthermore, these people feel that the entire supplemental needs of the plant, including all necessary elements, should be given in one dose of mixed fertiliser. Anhydrous ammonia backers feel that this is wasteful in some cases, as some of the elements may be lost through leaching. Application in excess of requirements in small increments as needed



Injecting anhydrous ammonia in milo maize at Hereford, Texas

can be used both before and after planting.

Pressure equipment must be used throughout, from manufacturing plant to soil. Applications are often made by the organisations selling the ammonia rather than by the farmer in order to obviate equipment costs which might be prohibitive to the farmer. Shell applies all anhydrous ammonia it sells, but this is true of no other producer. Custom applicators are on the increase and many large-scale farmers are buying their own equipment.

Storage is a big problem for anhydrous ammonia. It must be kept at a pressure of about 250 lb. which introduces a hazard which the farmer may not always be ready to cope with. Tanks are expensive. Distributing stations are the answer offered by some and a number of companies operating such stations are servicing farms in the South. Field tank requirements for ammonia have been estimated by the USDA at 164,500 tons for 1953 and 216,200 tons for next year. The greatest number are those ranging in size from 100 to 300 tons.

Storage of ammonia at the plant in such quantities as to meet rush season surges is very difficult. This was described recently in a speech by A. M. Smith, Mathieson Chemical Co.: ' It is impossible, both practically and financially, to build at a big plant enough tanks to store the production of weeks and months. At Morgantown at present, at the rate of 700 tons per day, there is sufficient storage for only three days of production. Sales departments work mostly five days a week, except during rush periods. The ammonia has to be moved; but the delivery and application of anhydrous ammonia to soils has been even more seasonal in many respects than with other fertilisers, because it has not been stored quite so cheaply.'

Hazards have been a subject of concern. But the problems are mostly those involved in handling any compressed gas, and applicators and farmers have learned rapidly. The development of state regulations which may vary has offered some problems, but the opinion on this matter seems optimistic at present. To date, five states have gone so far as to assign the administration of their regulations to a specific body: Arkansas, Georgia, Louisiana, Mississippi, and Tennessee. Some others appear ready to follow soon.

(From Agriculture and Food Chemistry.)

Photo: Phillips Chemical Co., Oklahoma.

Agricultural Education in Britain

A 16-page booklet published recently by the National Agricultural and Dairy Examination Boards presents a survey of the education and training opportunities for an agricultural career and gives information that should be of great value to prospective recruits to the industry and to those who have the responsibility of advising them. The booklet is entitled ' Agricultural Education ' and single copies will be sent free of charge on application to the Secretary of the Board at 16 Bedford Square, London, W.C.1.

The publication covers the prospects of agriculture as a career for men and women and deals with the inside range of opportunities for agricultural education provided by apprenticeship schemes, part - time vocational training and courses at farm institutes, agricultural colleges and universities.

Special emphasis is given to the training requirements and examinations for the national diplomas in (1) agriculture, (2) dairying and (3) dairy technology. These examinations are sponsored by two boards: the National Agricultural Examination Board, comprising six representatives each of the Royal Highland and Agricultural Society of Scotland and the Royal Agricultural Society of England, and the National Dairy Examination Board, comprising an additional six representatives of the British Dairy Farmers' Association. To date no less than 6,000 men and women have been awarded diplomas in dairying or agriculture. The diploma in agriculture, a technical qualification of special significance for prospective farmers and farm managers, involves training extending over two years at an agricultural college; for the dairy diplomas specialised training at approved centres for two years is also required. Preliminary conditions for pursuing these studies include a General Certificate of Education and not less than a year of appropriate practical farm experience.

The booklet gives valuable advice on the finding and selection of suitable farms for initial practical work and concludes with a comprehensive list of references for further information on the available educational facilities, fully documented with names and addresses.

The Problem of the World's Dams

The clogging up of the world's great reservoirs by water-borne sand and gravel, which may in the foreseeable future render them useless, will be discussed at two conferences to be sponsored by the Food and Agriculture Organisation of the United Nations this year. The problem will be discussed in some detail by FAO's European forestry commission working group on torrent control and avalanche protection, which will meet in Switzerland in June and July. It will also be dealt with by the Fourth World Forestry Congress at Dehra Dun, India, towards the end of the year.

The steady deterioration, at varying rates, of all the world's great dams is made more serious by the difficulty of replacing most of them at anything like the cost of the original dams. The original dam has, in most cases, been built on the easiest and cheapest site. Any dam which is to replace it must be built on a ' second-best ' site at greater expense and trouble. There is, therefore, today a growing tendency to classify dams as irreplaceable assets. At present dredging is usually not a practical or economically worth-while answer to siltation of a reservoir.

In a paper to be presented to the working group on torrent control, Mr. E. Widmann, of the French Water and Forest Service, concludes that by an intensification of the methods already in use for conservation of the ground cover of high mountain lands and watershed areas, as well as giving preference to some of the methods devised for torrent control, it would be possible to reduce siltation, although no presently known technique can prevent it entirely. Such conclusions emphasise again the need for watershed management, which has been, from the beginning, one of the most important of FAO's concerns.

British Ploughing Grants

The Minister of Agriculture and Fisheries laid before Parliament in May a draft statutory instrument on ploughing grants in England and Wales and Northern Ireland for the year beginning June 1, 1954. The Secretary of State for Scotland took similar action for Scotland. Subject to Parliamentary approval, grants will continue at the same rates as at present.

The rate which applies to the ploughing up and cropping of land which has been down to grass since June 1, 1951, is £5 per acre; £10 per acre grants are proposed to be continued for land which has been down to grass since 1939 and which requires specially heavy expenditure to bring into cultivation.

South African Crop Prospects

OUR correspondent in South Africa has recently sent us the following information on agriculture in the Union and in Southern Rhodesia.

Crop values

Farming contributed the record sum of £312 million to the Union's national income last year, according to the Division of Economics and Markets. This figure, representing the gross value of all field crops and livestock products during the 1952-53 season, was nearly £60 million higher than the figure of £251 million for the drought year of 1951-52.

Higher prices for wool and maize played an important part in the record figure, but the growing size of the wool clip and, above all, the record maize crop of 34 million bags were vital factors. The maize crop fetched the all-time record of £56 million. Wool, for the first time since the wool boom, brought in less than maize—£55 million.

The sugar industry

After producing a record sugar crop with sufficient to supply the needs of the Union and enough left over to export, the South African sugar industry has embarked on two major steps to boost output and improve efficiency. The first step is an aerial survey of all the sugar-cane lands in the Union, and the second is the introduction of a fertiliser advisory services bureau. The survey will cover an area of approximately 800,000 acres of sugar land and is expected to take two years at a cost of more than £50,000. The second step towards greater efficiency—the fertiliser advisory service bureau—is designed to take the hit and miss out of soil fertilisation methods. Sugar farmers can send specimens of soil to the bureau for analysis.

Wheat crops

This year's wheat harvest in South Africa will fall short of annual requirements by nearly 3 million bags and it will also be considerably smaller than the average yields of recent years. The decline was caused by the disappointing returns from sowings obtained in the Orange Free State, where the harvest was less than half the size of that reaped in the 1951-52 season, and in the Transvaal. The Cape, on the other hand, nearly established a new record and threshing reports indicate that the quality of the grain reached a high standard, chiefly because of the absence of inopportune rains shortly before and while the crop was harvested. The estimate for the 1953-54 season is 5,821,000 bags. The final estimate for the previous season was 6,086,000 bags.

Cotton production

Along the banks of the Orange River, mainly from Upington to Boegoeberg, cotton of a quality comparable with the best in the world is produced. The type grown there is Improved Bancroft, an American Upland seed type of good strength and fineness, and with a staple length which may range from $1\frac{1}{8}$ in. to $1\frac{1}{4}$ in., depending upon climatic and other conditions prevailing during a particular crop year. In this area production increased from 1,552 bales (500-lb. statistical bales) in the 1950-51 season to 10,031 bales in the 1951-52 season. For the 1952-53 season the crop has been estimated at 7,024 bales. The reason for this decline in production is ascribed mainly to the adverse effects of an outbreak of plant lice on the cotton, retarding growth. The area planted to cotton in 1950-51 was 3,000 morgen and it is said that it could easily be increased to 5,000 morgen, as cotton can be used in a crop rotation system with lucerne. Under irrigation, cotton produces an average yield of $3\frac{1}{2}$ bales of lint per morgen, so that a possible production of 17,000 bales from the Orange River area is not unlikely. This can be obtained without reducing the production of essential stock feeds and human foodstuffs. Generally speaking, severe insect damage hardly ever occurs in this area because of its isolated position, and the Improved Bancroft type is not subject to attacks by jassids to any appreciable extent.

Fruit exports

According to details of exports of fruit issued by the Deciduous Fruit Board for the current season up to March 10, 1954, the exports of apples were 3,080 tons of 2,000 lb., 939 tons of apricots, 9,052 tons of grapes, 19 tons of nectarines, 834 tons of peaches, 11,677 tons of pears and 2,194 tons of plums. Exports of apricots, peaches and nectarines for the current season have now been completed. Shipments of plums so far can be compared with the 2,543 tons of the previous season. The quantity of pears exported was 3,647 tons less than the total of 15,324 tons of the corresponding period of the previous season. Sales on overseas markets are realising satisfactory returns with prices for apples and pears generally approximately at last year's levels. The demand at market sales in Johannesburg, however, has eased as a result of competition from heavy offerings of Transvaal-grown fruit and prices for the Cape fruits sent there are consequently disappointing.

Maize in the Union

Conditions continue to be favourable in the principal maize-growing areas of the Union and the harvest at an estimated 38,184,000 bags promises to break all records. The largest yield is expected in the Transvaal, exceeding 16,900,000 bags, followed by the Orange Free State with some 15,700,000 bags. The Cape should yield 2,900,000 bags and Natal nearly 2,600,000 bags. The estimates for the four provinces are in every case higher than for the previous season. The price of maize to be paid to the producers has been reduced by 1s. to 31s. per bag for the current season, but the higher yield is expected to earn growers £59,185,000, as against £55,725,000 in the previous season.

Rhodesian tobacco

Prospects for this year's Southern Rhodesia tobacco crop are considered promising. Weather conditions during the present growing season were on the whole favourable and only in a few areas were the tobacco plants retarded by drought. It is expected that the flue-cured crop will be large and of satisfactory quality. The harvest is estimated to total 117 million lb. this season, which is about 12 million lb. more than in the previous season when the yield constituted a new record. This season a rather smaller area was planted to tobacco. The first auctions of the 1954 season were held in Salisbury on March 24. The 419,406 lb. of flue-cured leaf sold fetched an average of 37.23d. per lb., and the 8,648 lb. of strip 13.15d. per lb. Most of this leaf was below average quality, but there were a few consignments of better-grade leaf and this attracted keen competition. The reaping and curing of the Northern Rhodesia tobacco crop has now been completed and that was followed by the grading. The early reapings cured out well, the leaf this season being found mainly free of alternaria and other diseases. The average yield is expected to be a little higher than for last season and generally the crop seems to be of better quality. The preliminary estimate placed the yield at 3 million lb. of flue-cured Virginia and 120,000 lb. of Burley from the eastern area, and 5,900,000 lb. of flue-cured Virginia from the western area.

Pineapples in Australia

The main pineapple growing area is situated in Southern Queensland, but production has lately become a profitable venture in the Murwillumbah district of New South Wales, south of the border. Nearly 400 acres have been planted in pineapples there in the past few years and growers now number 150, many of them dairy farmers or banana growers as well. Queensland has some 8,500 acres producing pineapples principally in the coastal area between Brisbane and Maryborough, 150 miles further north. It is an industry worth well over £A1 million to that State.

Development has been so rapid in northern New South Wales that two fruit-canning companies have decided to build factories in the area, specifically for pineapples. At present pineapples grown in the area have to be sent 600 miles by train to Sydney, which makes freight an expensive matter. Much of this canned fruit goes to markets overseas.

The new canneries will do a great deal to stimulate production and already a number of farmers are planning to plant pineapples. A tropical case, weighing 65 lb., contains from 18 to 21 medium-sized pineapples and sells for £A1 5s. od.; cases carrying fruit for canneries are a little larger in size and average 75 lb.

In northern New South Wales it is becoming the standard practice to grow both pineapples and bananas, although each require a different kind of land. Bananas are grown on steep hillsides, sheltered from winds, pineapples on more level ground. The essential requirements, apart from good soil, are that the area has good drainage and is free from frosts. Hence pineapples are usually grown well above sea level where sea breezes dispel the risks of frosts.

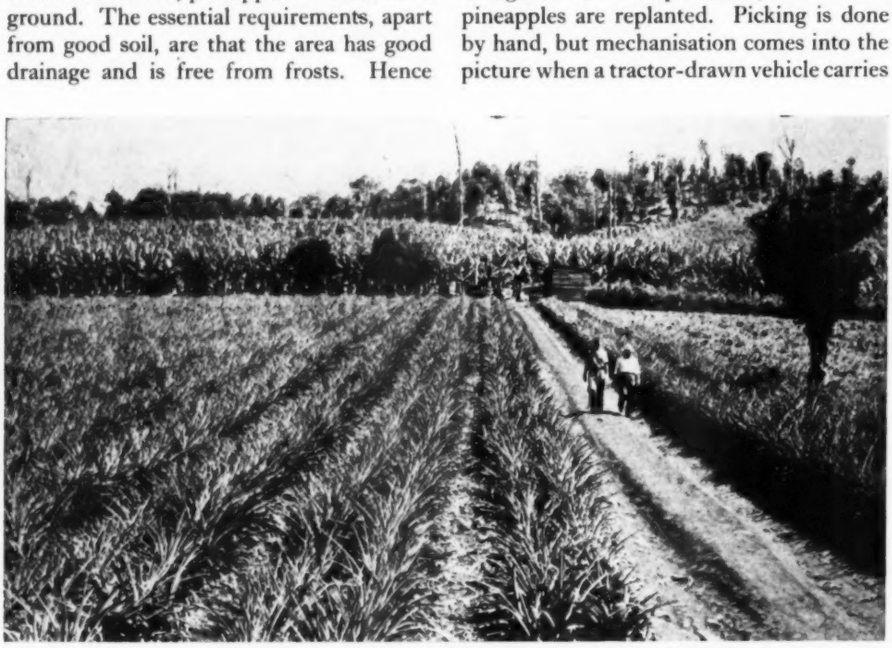
The variety of pineapple generally favoured is the smooth Cayenne, noted for its sweetness and quantity of juice. Some growers also have the Ripley variety, though it is not so popular.

In New South Wales the average production to the acre amounts to between 200 and 250 tropical cases. It is, however, estimated that with good cultivation under favourable conditions it is possible to produce between 500 and 700 cases to each acre.

It is worth noting that for optimum yields pineapples are planted in double rows 6 ft. apart, each plant 1 ft. away from its neighbour. The idea of the double row is to enable two plants to hold each other up, since the fruit is heavy for the size of the plant and would otherwise topple over. This gives some 14,500 plants to the acre. Plants are given four applications of fertiliser each year, sulphate of ammonia being thrown on the leaves. Irrigation is carried out in summer time only, using an overhead spray.

The heaviest crop is the summer one; taken off usually in February, March and April. Fruit continues to ripen until June, however. A slack period follows up to August, when picking the winter crop occurs over the following two months. After five or six years the plants which ratoon (send up new shoots) are pulled out. A legume cover crop follows, after which pineapples are replanted. Picking is done by hand, but mechanisation comes into the picture when a tractor-drawn vehicle carries the fruit away from the rows to the packing shed.

The prosperous nature of this industry is underlined by the value today of land suitable for pineapple growing. There is a good deal to be opened up yet, but the purchase price is at least £A200 an acre.



Many growers in northern New South Wales, as on this farm, plant pineapples on gently sloping ground and bananas on the steeper hillsides beyond

Retirement of Sir James Scott Watson

Sir James Scott Watson, C.B.E., LL.D., D.Sc., Chief Scientific and Agricultural Adviser and Director-General of the National Agricultural Advisory Service in the Ministry of Agriculture and Fisheries, will retire from the public service at his own request on December 31 next, shortly after reaching the age of 65.

Professor H. G. Sanders, M.A., Ph.D., Professor of Agriculture, Reading University, has been appointed to succeed Sir James Scott Watson as Chief Scientific and Agricultural Adviser to the Ministry.

South African Appointment

We hear that at a general executive committee meeting of the South African Wattle Growers' Union in February, a proposal by the union's newly-formed mechanisation committee to appoint Lt.-Col. W. N. Bates, A.M.I.Mech., M.I.B.A.E., as technical secretary (honorary) to the mechanisation committee was approved.

Many of our readers will no doubt remember Col. Bates from the years he spent with B.A.M.M.E.X. before going out to South Africa in July 1951 to take up an appointment as technical adviser to a group of British agricultural implement manufacturers.

United Kingdom Agricultural Representative in Australia

Mr. C. W. Strutt, B.Sc.(Agric)., returned to the United Kingdom on March 26, 1954, after a five-year tour of duty as Agricultural Adviser to the High Commissioner to the United Kingdom in Australia. He was succeeded by Mr. Thomas Cross Creyke, N.D.A., N.D.D.

From 1934 to 1936 Mr. Creyke was employed by the Milk Marketing Board before joining the East Anglian Institute of Agriculture as lecturer. Since 1944 he has been County Agricultural Officer first to the Lancashire and then to the Yorkshire (North Riding) Agriculture Executive Committees.

NEW BOOKS

Plants for Man

By Robert W. Schery. Pp. vii + 564. London. George Allen and Unwin. 1954. 70s.

In this work the author, who was formerly assistant professor of Botany in Washington University, has attempted to provide a conspectus of the members of the vegetable kingdom which are of use and value to man and to bring together what he describes as the fundamental gleanings of an immense scattered and usually uncorrelated field.

The book itself, after two short introductory chapters in which the author discusses man's dependence upon plants and his economic interest therein, deals in three successive parts with (*a*) products derived from the cell walls of plants, (*b*) cell exudates and extractions and (*c*) plants and plant parts used primarily for food and beverages.

The treatment is of necessity encyclopaedic in character, and a vast amount of information is stored within the 564 pages of this ambitious work. Some of the information given, it must be admitted, seems rather open to criticism. Thus in regard to the section on rubber dealt with under Part 3, ' Cell Exudates,' it is somewhat surprising to find that although a large section is devoted to the extraction of rubber from wild trees in the Amazon forests, there is no description of procedure on the rubber plantations in the Far East. Indeed the development of the great rubber plantation industry largely under British auspices seems by the author to be regarded as a doubtfully creditable enterprise, inasmuch as Wickham's action in obtaining hevea seed from the Amazon is described as a dubious distinction, an act of smuggling in fact, connived in by the British Government; no mention is made of the fact that of the plants shipped from Kew a part went to Singapore, and that it was Ridley's patient work over many years which ultimately demonstrated the suitability of rubber to the Malayan climate and led to the beginnings of the extraordinary expansion which took place, under the clamant demands of the then infant automobile industry.

On page 319 the fruit of the African oil palm is described as ' like a small coconut '; this is of course incorrect—the fruit occurs in large bunches and is really a drupe.

On page 524 the Mexican beverage ' pulque maguey ' is described as being obtained by the spontaneous fermentation of the juice obtained from the leaves of crushed Agave leaves. This is an error, as actually it is obtained from the base of the severed flower-bearing stem, which is hollowed out to allow the juice to collect.

It is, however, inevitable that in a book of this type and scope some errors should occur, and apart from the somewhat marked anti-British prejudice which appears at some points it can be commended as a useful compilation which comprises much valuable information within a relatively small compass. The book is clearly printed and illustrated with a profusion of photographic reproductions.

H. T.

Life from the Soil

By Col. H. F. White and Sir C. Stanton Hicks. Pp. 317. London. Longmans, Green. 25s.

This book could equally well be two independent books, one by each author, for there is little essential connection between them.

The first half is by Col. White, an Australian sheep farmer interested in establishing productive leys. He finds that although phosphate is needed initially, the leys tend to go back rather quickly, and not to respond further to phosphate application. His half of the book consists principally of his reflections on the cause of this, and it contains a large number of quotations from many sources, mostly concerned with the benefits that ought to be derived from maintaining the organic matter content of the soil. It is not at all clear if any of these are relevant to his problem, for he does not seem to have discovered how to prevent the deterioration of his leys.

The second half of the book is by Sir Stanton Hicks, who is Professor of Human Physiology and Pharmacology at Adelaide University. He is concerned to show that the nutritional quality of the food we eat depends both on the methods of farming practiced and on the financial policy of Governments and industry as it affects agriculture. The text is enlivened by long extracts from Justus von Liebig's polemical writings.

E. W. Russell.

The Soil

By G. V. Jacks. Pp. 221. Edinburgh. Thomas Nelson. 12s. 6d.

The author of this book is the Director of the Commonwealth Bureau of Soil Science, and it is written for the farmer and the student of agriculture. Hence it aims at giving a straightforward account of what the soil is, what constitutes soil fertility, the problems of soil classification, and the causes and control of soil erosion. The outlook throughout the book is novel and refreshing, for the author keeps the reader aware that soil fertility is biologically determined, and anything that man does to the soil alters its biological environment. He also continually stresses the fact that the most important organism altering the soil is man himself.

Whilst the general presentation of the subject is excellent, the text is somewhat marred by a number of statements that are either unproven or misleading. This is a pity because although none are serious in themselves, they may cause unnecessary confusion in the reader's mind. Further, the chemical language used is inconsistent and in places inaccurate. The author has not made up his mind whether to use the old-fashioned but usual language of soil chemistry, *e.g.* potash, soda or lime, or the modern language—potassium, sodium or calcium; these are used indiscriminately even in the same sentence. Again ammonia (NH_3) is used when ammonium (NH_4^+) is meant, and phosphate is assumed to be present and taken up by the plants as PO_4, which must be incorrect.

The book is well illustrated and includes six colour photographs of soils. It is excellent value for 12s. 6d.

E. W. Russell.

Vegetable Oils and Oilseeds, 1953

A summary compiled by the Intelligence Branch of the Commonwealth Economic Committee. Pp. 155. London. H.M.S.O., 1954. 5s.

This is the usual annual review of world trade in vegetable oils and oil seeds compiled by the Commonwealth Economic Committee, and contains a mass of information concerning these essential products.

It appears from this that world supplies available for use as food in 1953 remained higher per head of population than in the pre-war years, while world output, although slightly lower than in the record year 1952, was still nearly one-fifth greater than pre-war. Preliminary details for 1954 indicate that a very high level of production should again be reached, while stocks, notably in the United States, are abnormally large.

The net supplies of vegetable oils and oilseeds entering into world trade during 1952 amounted to some 3.3 million tons, in oil equivalent, compared with 3.9 million tons in the previous year and 4.3 million tons in 1938. Preliminary details for 1953 indicate little overall change in the volume of trade; prospects for 1954, however, are good, especially for groundnut and cottonseed oils, which have been

in relatively short supply since the war. Production of oilseed crops in the United States has remained well above pre-war and this, together with the decline in the output of soap (reflecting the increase in synthetic detergents), has resulted in considerably increased exports from that country and sharply reduced imports. The supplies available during recent years to importing countries, other than the United States, have consequently been only slightly below the pre-war level.

The British Commonwealth normally accounts for between one-fifth and one-quarter of world oilseed crop production, and is even more important in relation to world trade. The improvement in Commonwealth exports during 1952 was mainly attributable to the recovery in shipments from Nigeria, although copra and coconut oil supplies from Ceylon were also at a high level and total exports from India were fairly well maintained. Preliminary details for 1953 indicate record shipments from Nigeria but a moderate decline in exports from some other countries. Prior to the war, the Commonwealth had a large trading surplus in oils and oilseeds, especially in groundnuts, copra and palm kernels. The subsequent marked decline in Indian exports and the rise in United Kingdom purchases have much more than offset the heavier Nigerian shipments.

Prospects for 1954 indicate a high level of Commonwealth exports, which may, however, be accompanied by heavier United Kingdom imports. Other Commonwealth exporting countries include Malaya, New Guinea and Papua, Fiji and other British Pacific Islands, British East Africa, Sierra Leone and Gambia, in each of which there have been developments in the oilseed industry since the war and, in general, some increase in production.

A significant post-war development has been the increasing proportion of produce shipped in the form of oil, as opposed to seed, following the expansion of crushing industries in many seed-producing countries, both Commonwealth and foreign.

The book contains detailed statistical appendices showing the annual available supplies of vegetable oils in important consuming countries, the production of soap, margarine and compound cooking fat, with the utilisation of oils and fats in these commodities, and a section on whale oil production and trade.

Fish Culture in Central America

Following upon the article on fish culture in last month's WORLD CROPS, readers may be interested by the report that 100 offspring of Israeli carp sent by FAO to stock Haiti's streams and ponds have continued their families' travels on to Mexico, where they are to be used to stock the waters of the country's central highlands.

They were taken to Mexico recently by José Alvarez Villar, head of Mexico's Fish Culture Commission, who had just completed a three weeks' study of FAO's fish culture programme in Haiti under a fellowship granted him by the Inter-American Mission (Point 4). Mr. Villar carried out his studies of fish culture in Haiti with Shimon Tal, the Israeli fish culturist, whom FAO sent to Haiti under the Expanded Technical Assistance Programme.

Haiti's livestock industry is incapable of supplying the protein food needs of the high population of the Republic, so development of the fish farming industry is of great importance in raising nutritional levels of the population. It is hoped to raise Haitian pond and stream fish production to at least 15,000 tons per year. The carp fingerlings which Mr. Villar took home to Mexico with him were the first offspring of Israeli carp taken to Haiti in September last year. When they arrived in the country they weighed less than 4 oz. each. At the beginning of February, when they spawned for the first time, they had reached an average weight of 8 lb. All the commercial ponds in the Republicare to be stocked with the Israeli carp.

Technical News

The July issue of *Fibres (Natural and Synthetic)* contains 'New Horizons for Fibrous Raw Materials for Paper Manufacture' by Dr. Julius Grant and 'New Zealand's £6½ Million Paper Plant' by H. Walders.

Articles appearing in *Food Manufacture* for July include 'Gelatin—From Raw Material to Finished Product'; 'Progress with Quaternary Ammonium Compounds'; 'Pilot Plant Production of a Milk Substitute from Groundnuts'; and 'The Manufacture of Active Dried Yeast.'

In the July issue of *Petroleum* P. F. Ellis writes on 'Bulk Oil Storage,' while E. G. Ellis discusses 'Trends in Modern Viscometry.' This issue also contains 'Petroleum Chemical Processes—1' by P. W. Sherwood, and 'Oil in South Africa' by A. G. Thomson.

The main contents of *Paint Manufacture* for July will be 'The Chemistry of the Metallic Soaps' by J. H. Skellon and J. H. Taylor; 'Carbon Blacks for Protective Coatings—2' by L. J. Venuto; and 'Conophor Oil' by G. T. Bray.

Caterpillar Co. Chairman

Mr. L. B. Neumiller was elected chairman of the board of the Caterpillar Tractor Co. at a recent meeting of the board held at the company's corporate office in San Leandro, California. Mr. H. S. Eberhard was elected president to succeed Mr. Neumiller, who has been Caterpillar's president for the past 12 years.

Mr. H. H. Fair, who resigned the board chairmanship at this meeting, will continue as a director. Mr. Fair has been closely associated with the tractor business since 1918, and was the prime mover in the formation of Caterpillar Tractor Co. in 1925.

At the same meeting the board voted to discontinue the executive committee, whose chairman, former president B. C. Heacock, is retiring from operations at this time but will continue as a director. All other incumbent corporate officers were re-elected.

Ethiopian Farm Machinery Demonstration

The Emperor of Ethiopia, His Imperial Majesty Haile Selassie I, made a personal inspection recently of some of the modern farm machinery which his country has just imported from Britain. For several hours, accompanied by members of his staff and Government, he recently walked round the Imperial Farm near Addis Ababa studying the equipment and watching it being demonstrated by an expert from England.

The occasion was the first full-scale demonstration to be given in Ethiopia of the Ferguson system of farm mechanisation. Ethiopia, being predominantly an agricultural country, agriculture is the first concern. Officials of the Food and Agriculture Organisation and of United States 'Point 4' aid are helping the authorities to set up agricultural colleges and schools and to plan scientific improvements.

The Emperor's attendance at what might justifiably be called the launching of mechanised farming in his country was a great encouragement to those who regard mechanisation as one of the keys to agricultural progress.

The demonstration was organised by Paul Ries and Sons (Ethiopia) Ltd., recently appointed by the Massey-Harris-Ferguson organisation as their distributors for Ferguson equipment. It was given by Mr. Peter Titchmarsh, who flew out from England for the occasion.

Among other machines demonstrated were ploughs, cultivators, trailers, a seed drill, a blade terracer, a woodsaw and a post hole digger.

FARM MACHINERY

Rotary Hoes Demonstration

A demonstration was held by Rotary Hoes Ltd. in Essex recently of two new Rotavators—the Howard Rotavator ' Yeoman ' and the ' Bulldog.'

The ' Yeoman ' is a medium-size, hand-controlled cultivator designed for growers who want something larger than the ' Bantam ' yet smaller than the ' Gem.' It carries a full range of attachments, which are fitted and removed by a new method—the ' Snaplok ' quick-release clamp. Power for the ' Yeoman ' comes from its Villiers Mk.40 petrol engine. The Mk.40 is a four-stroke, single-cylinder, air-cooled (fan) engine which develops 4.2 b.h.p. at 2,150 r.p.m.

A power take-off stub is fitted to the rear of the transmission housing. It is slightly offset to the right and carries its own hand-operated sliding dog. A three-position wheel lock puts both wheels in or out of gear or applies drive to one wheel only (for easy turning). The transmission controls are conveniently grouped round two central quadrants.

The handlebars are adjustable for height and can be swung laterally to either side.

The rotor has a bevel gear primary drive. Final drive is by $\frac{3}{4}$ in. pitch roller chain through a multi-plate friction safety clutch. The width of cultivation is 15 in. Depth of cultivation is adjustable to 9 in. maximum in most soils. The rotor carries eight blades, each being held by two robust bolts. The dished wheels permit variation of the track width of the ' Yeoman ' to suit row width. By reversing the wheels track width is increased.

The ' Snaplok ' quick-release clamp

This method of mounting and unmounting attachments comprises an over-centre linkage forming a quick-acting, lever-operated clamp which permits the rotor, or other attachment, to be removed by the single operation of the lever. The attachment is registered by a large diameter spigot and dowel pins on a flat surface, giving complete location and rigidity. The over-centre linkage is fitted with a simple screw-type adjuster to facilitate taking up wear over the clamping faces.

The full range of ' Yeoman ' attachments will include cutter bar, front and rear toolbars, belt pulley, V-belt p.t.o. unit, truck hitch, drawbar, furrower, sprayer and generator cradle. Approved implements will include hedgetrimmer, electric generator and three-gang seeder.

The ' Bulldog,' which was also demonstrated, is a small hand-controlled digging tool designed particularly for gardeners and nurserymen.

Portable Sprayers

Two new portable power sprayers, designed to meet any moderate spraying need, are being produced by the F. E. Myers and Bro. Co. of Ashland, Ohio. Compact enough to be used by the average home owner in gardening and landscaping, the new sprayers are stated to have sufficient pump capacity and pressure to be utilised by greenhouse operators, truck and landscape gardeners, farmers, park and estate caretakers and others.

The new portable ' Silver Prince II ' sprayer which is stated to spray at 2 gal. a minute

The ' Silver Prince II ' sprayer holds up to 12½ gal. of spray material and can spray at 2 gal. a minute. Only 35 in. high and weighing 152 lb. empty, the ' Silver Prince II ' is easy to move from one spraying job to another and requires little storage space when not in use. The ' Squire ' sprayer holds up to 50 gal. of spray material and sprays at 4 gal. a minute. It is available either with pneumatic tyres or as a skid-type for mounting in trucks.

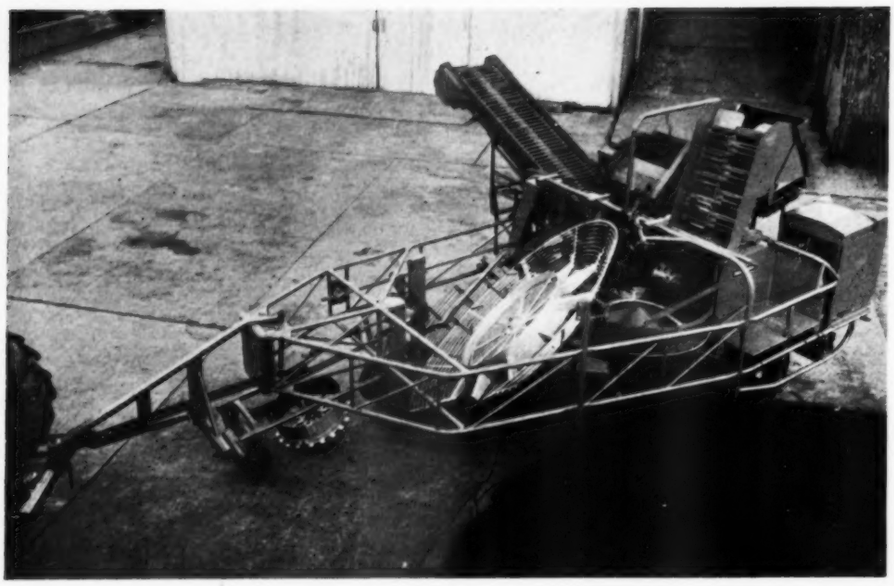
Both sprayers feature new heavy duty ball bearing spray pumps which are permanently lubricated and sealed. The pumps have porcelain-lined cylinders which are not affected by the corrosive action of spray materials. The pumps are available as separate units for engine or power take-off application. The single cylinder pump furnishes 3 gal. a minute when used separately and the double cylinder 6 gal.

Either sprayer can be powered by a gasoline engine or electric motor. Other features include a heavy, corrosion resistant steel tank—arc welded—with a splash proof cover and filler opening.

The new Rotavator ' Yeoman ' on inter-row work. The width of cultivation is 15 in. and the depth is adjustable to 9 in. in most soils

Packman Potato Harvester

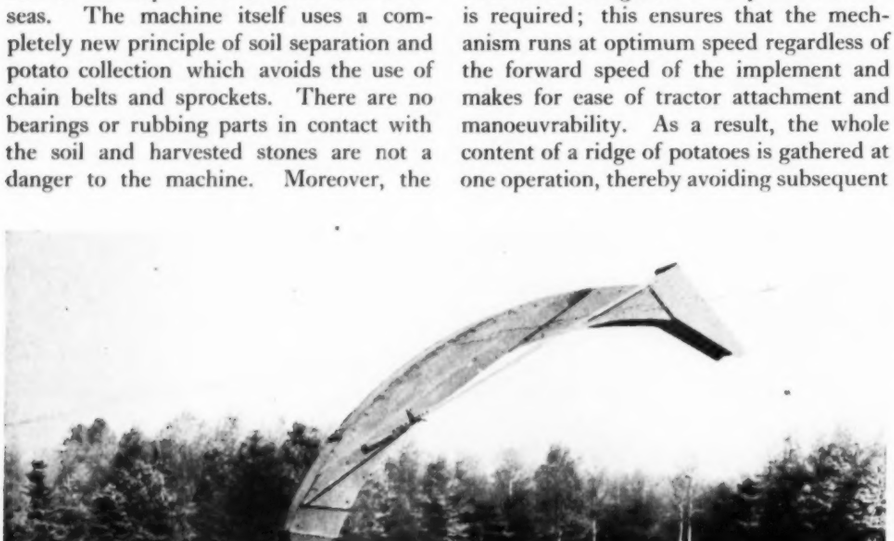
At a press conference in London on May 10 details were given of the Packman potato harvester, which, it is anticipated, will shortly be brought into production.



The Packman potato harvester

The machine is particularly interesting inasmuch as its production is partly sponsored by the National Research Development Corp. in conjunction with Messrs. Thomas Storey Ltd., who have acquired the exclusive rights of manufacture and sale of the implement at home and overseas. The machine itself uses a completely new principle of soil separation and potato collection which avoids the use of chain belts and sprockets. There are no bearings or rubbing parts in contact with the soil and harvested stones are not a danger to the machine. Moreover, the haulms of the potatoes are removed before they are exposed, thus avoiding the transfer of disease. Handling of the crop is gentle and the machine has a separator for the mechanical removal of stones, hard clods and rubbish. The machine is self-contained with its own engine and no power take-off is required; this ensures that the mechanism runs at optimum speed regardless of the forward speed of the implement and makes for ease of tractor attachment and manoeuvrability. As a result, the whole content of a ridge of potatoes is gathered at one operation, thereby avoiding subsequent harrowing operations and further harvesting, while the weight of the machine has been kept down to the minimum.

In connection with this machine the inventor has also devised a potato planter, which is also manufactured by Messrs. Thomas Storey, the point being that for effective operation by the harvester it is essential that the potatoes should be planted with great accuracy in the rows, and this the planter is designed to do.



The Silorator ' Hayter ' harvester

The Silorator Hayter Harvester

The Silorator ' Hayter ' harvester is a tractor-drawn power take-off driven, direct out forage harvester of revolutionary design in which the normal cutter bar mechanism is replaced by high-speed rotary cutters and the more generally known barrel or drum-type chopper is represented by the Silorator.

The rotary cutters are able to cut a very wide range of crops, some of which are far beyond the capacity of a reciprocating cutter bar, and the Silorator not only reduces the length of the crop, but lacerates it, and this process has been shown beyond all doubt to be of immense advantage in silage making and considerable help in grass drying and sheet composting; in addition to which the Silorator may be used in a stationary role for pulping, prebreaking, aeration, grain blowing, etc., and the whole harvester may be used without modification as a pick-up or direct out lacerator and spreader of combine straw, standing straw or green manures, and in allied application, such as pasture topping.

Siloration is a form of laceration which produces a flaccid product with obvious advantages in ease of handling, compaction, temperature control, etc., but its greatest advantage in this field is the release of cellular plant constituents. Of these, in particular, the carbohydrates immediately become available to the lactobacilli, which are thus enabled to multiply quickly and supply an adequate quantity of the enzymes which are catalysts in the reaction producing lactic acid. The rapid acidification which results soon achieves a pH of 4.2, below which butyric acid will not be produced, and so a well-fermented sample results.

The Silorator has produced conditions in which rapid correct fermentation is assured by its lacerating action, and thus obviates the necessity for additives provided there is sufficient fermentable carbohydrate present in the crop. This action is quite distinct from cutting and chopping and results in the production of very high-class silage.

Exhibits at the B.I.F.

Mr. C. Anderton, general sales manager of Clifford Aero and Auto Ltd., beside his company's stand at Birmingham

At the Castle Bromwich section of the British Industries Fair, which took place from May 3 to 14, there were several agricultural items of interest exhibited.

The **Villiers Engineering Co. Ltd.** showed its range of power units from ½ to 5 h.p. For approved applications the company is now offering its four-stroke engines for high-speed running, with consequent increase in power output. This increased power is obtained by various modifications. An entirely new engine is the Villiers Mark 15 model which was exhibited for the first time. This engine, interchangeable dimensionally with the Mark 10/12, develops 1.6 h.p. at 2,000 r.p.m. and 2 h.p. at 2,500 r.p.m., and has been designed especially for use on small cultivators, scythes and other farm machines requiring high torque over a wide speed range with particular emphasis on good pulling at lower speeds.

A wide range of machinery was shown by **Ransomes Sims and Jefferies Ltd.,** including the M.G. tractor, forklift trucks and lawn mowers. An MG6 tractor with petrol engine fitted with the Ramdozer attachment was shown. This attachment converts the MG into a practical bulldozer and solves the problem of dealing with the lighter type of work for which a larger bulldozer would be unsuitable and uneconomical. This attachment is said to be ideal for levelling, back filling trenches, snow clearing, making paths and roads and for all kinds of load shifting. The 48 in. blade is fitted with a renewable cutting edge and can be angled 30° to the right or left. The capacity is approximately ¼ cu. yd.

Also exhibited by this company was an MG6 tractor with petrol engine, tracks fitted with rubber blocks, hydraulic lift and standard three-point linkage with c.67 toolbar frame fitted. This exhibit demonstrated the use of the hydraulic lift, and the toolbars are said to be ideal for accurate and economical, general and inter-row cultivation.

A 'Silo-Aid' is demonstrated

Clifford Aero and Auto Ltd. showed its power cultivator, a machine which is stated to have been steadily making a name for itself, not only on small plots of land in Britain, but on holdings and plantations in many parts of the world; this machine is equally at home between rows of peas in Worcestershire or cotton fields in Egypt. This versatile machine not only provides growers with a quick and efficient means of soil preparation, but an extremely useful range of implements finds good use for the 'Clifford' all the year round. These attachments are easily fitted and are said to make speedy work of such varied jobs as ploughing, potato lifting and spinning, ridging, hoeing, soil shredding, etc.

Four models are available at prices from £120, the latest being the 7½ b.p.h. B.S.A. engined Mark IV.

The **Wolseley Sheep Shearing Machine Co. Ltd.** had as usual a wide range of machines and equipment on show, including the new 4 in. pump unit. This is said to give a remarkable performance for a 5 h.p. unit as it will deliver up to 2 tons of water per minute at low heads and to be capable of covering one acre of land with 1 in. of water in less than one hour. Also shown were 2 in. model F.F.200 and 3 in. pump. The 2 in. pump is powered by the W.D. engine, developing 3 h.p. while the larger capacity 3 in. model F.F. 303 and the new 4 in. model F4K are powered by the 5 h.p. W.L.B. engine. There are no pulleys or couplings, the impellor is mounted directly on to the crankshaft and the pump housing on to the engine crankcase, producing one complete unit with maximum efficiency. The company also showed its 1½/5 h.p. four-stroke air-cooled engine suitable for all types of farm machinery as well as industrial purposes. It will run on either petrol or paraffin. Conversion to paraffin operation is obtained by adding an easily-fitted patented elbow that directs hot air from cooling fins to carburetor, dispensing with the need of a vaporiser.

The 'Silo-Aid' was shown by **Atkinson's Agricultural Appliances Ltd.** This is a semi-automatic power-operated tool for cutting silage, peat, etc., incorporating an oscillating blade driven by a 31 c.c. two-stroke petrol engine. The tool is said to be well balanced, easy to maintain and handle. It has a total weight of 40 lb., a minimum of moving parts and operation can be easily effected by man or boy. When the blade has reached its full depth of approximately 8 in. a slight rocking movement by the operator causes the machine to inch along in the direction of the required cut. On test the machine is said to have cut at the rate of 12 ft. per minute

This earth-boring machine, capable of boring 9 in. to 30 in. diam. and 11 ft. and 21 ft. deep, was exhibited at the B.I.F. by the Cheshire Engineering Co. A trencher was also shown

to a depth of 8 in. The tool is designed to cut a straight face and square corner.

A new range of Onions open bowl scrapers was exhibited for the first time by **Jack Olding and Co. Ltd.** Three new models have been added to the range, which was started by the Model 12-16 produced two years ago. As a result of the experience and satisfactory performance gained with the Model 12-16 it was decided to extend the open bowl design to three further sizes of scrapers, their designation being the models 3-4, 8-11 and 15-21. Since in recent years tractor manufacturers have developed their machines and raised the drawbar pulls available for scraper operation, the new Onions scrapers have a greater capacity in order to make full use of the power available in the tractors. In doing so they provide operators with a means of raising the output and reducing operating costs.

The Onions open bowl scraper design incorporates many of the well-proved features of the earlier Onions overhead beam type scrapers and, in addition, has the advantage of a lower centre of gravity which, coupled with the rear wheels set to the full width of the bowl, provides improved stability when operating over rough ground. The apron opening has been raised to permit loads to be ejected in a shorter time and with greater ease.

Machinery at the Royal Show

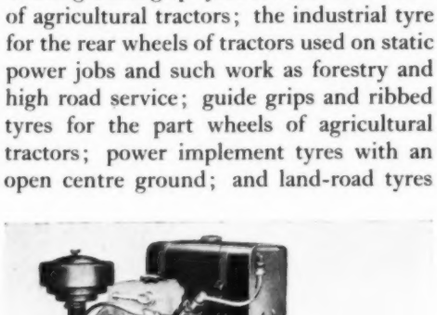
This year the Royal Show will take place at Windsor from July 6 to 9, and a report of it will be appearing in our next issue. We have recently received details of a few of the exhibits:

Dale Electric (Yorkshire) Ltd. will be showing one of the smallest diesel-electric generating plants in the country. This plant has been designed to meet the need for a small diesel-driven generating plant, reasonable in first cost, and cheap to run and maintain. It is said to be very suitable for small farms, cottages, mobile workshops, etc.

Cloches, trickle irrigation, dedutchable glasshouses, soil block machines and other items will be shown by **Chase Protected Cultivation Ltd.**

The electricity exhibit has been organised jointly by the **Electrical Development Association** and the **Southern Electricity Board.** Separate sections will be devoted to the application of electricity in the dairy, to water supplies, the farm workshop and pig and poultry keeping. Grain drying and barn hay drying by electricity will also be featured by full-scale plants, together with handling, milling and food preparing appliances.

At the stand of the **Firestone Tyre and Rubber Co. Ltd.** this year the following examples will be shown from the wide range of Firestone agricultural tyres: open centre ground grip tyres for the rear wheels of agricultural tractors; the industrial tyre for the rear wheels of tractors used on static power jobs and such work as forestry and high road service; guide grips and ribbed tyres for the part wheels of agricultural tractors; power implement tyres with an open centre ground; and land-road tyres for free-rolling wheels on farm trailers and drawn vehicles where minimum rolling resistance is essential. The company will also show horticultural tractor tyres for light trolleys and for depth-control wheels on the tractor tool bars.



The Dale diesel-electric generating plant

A wide range of agricultural implements will be shown by **Denings of Chard Ltd.**, including the ' Somerset ' 12-row grain and fertiliser drill. The latter is stated to stand up to the vigorous treatment to which all tractor-drawn drills of this type are subjected. It is supplied with either disc or Suffolk coulters and markers are included. The company will also be showing saw benches, disc harrows, potato spinner, mower, hay sweep, and side delivery rake and swath turner.

Eversman Machinery Leaflet

We have received a leaflet describing various agricultural implements manufactured by the Eversman Manufacturing Co. of Denver, Colorado. The leaflet describes automatic land levellers and dirt movers, hydraulic scrapers, a rubber-mounted floating hitch ditcher, a pan breaker attachment and a machine which mechanically thins, blocks and chops cotton, sugar beets and vegetable crops.

WORLD CROP REPORTS

WORLD

Maize production. World maize production in 1953-54 is estimated at 5,775 million bushels. Most of the increase is in Southern Hemisphere countries, especially Argentina and the Union of South Africa, where the outlook improved somewhat during the latter part of the growing season. The current estimate is 145 million bushels larger than the 1952-53 total of 5,630 million and is second only to the record production of 5,995 million bushels in 1948-49.

Total supplies of maize available for export from the principal exporting countries are somewhat larger than those of a year ago, especially in Argentina, traditionally the world's principal exporter of maize. The considerably larger crop now being harvested brings that country's export potential to the highest point of recent years. A succession of very low outturns in that country brought total exports for the past four seasons to an average of only about 30 million bushels. This contrasts with the pre-war average (1935-39) of 240 million bushels and the record exports of 390 million bushels in 1931. Unofficial estimates place Argentina's exportable surplus for the year beginning April 1954 at 145 million bushels.

Total maize supplies in the United States are at a near-record level this season, a heavy carry-over offsetting some reduction from last year's production. Supplies of 3,946 million bushels at the beginning of the season were about 3% below the record supplies of 1949-50. Exports of maize have been running considerably below those of the comparable period a year ago and appear likely to be somewhat smaller for the season. Present indications point to a record carry-over at the end of the current season.

The crop in North America is now placed at 3,385 million bushels, compared with 3,482 million in 1952 and the all-time record of 3,860 million bushels in 1948. The United States production of 3,177 million bushels this season is 55% of the estimated world total. Both acreage and yields per acre were slightly below those of 1952. Production in Mexico, the second largest maize producer of the area, is now estimated at 126 million bushels, the same as in 1952.

Maize production in Europe is estimated at 650 million bushels, 35% above the small outturn of the previous year. The 1953 harvest was still, however, below the pre-war averages of 695 million bushels. Though increases over the small 1952 outturn were general, gains were greatest in the Balkans, where the maize crop was reduced sharply by the severe drought of 1952. Maize is a relatively small crop in the Soviet Union, amounting to only about 4% of the United States production during 1945-49. The 1953 harvest was indicated to be the smallest of recent years, on the basis of unfavourable growing conditions in some important producing regions.

In Asia the 1953 maize crop is estimated at 700 million bushels, compared with 735 million in 1952 and the pre-war average of 620 million. Production in Africa is now estimated at the high level of 340 million bushels. This is about 30 million bushels above earlier-season estimates, principally because of improved prospects for the Union of South Africa. That Southern Hemisphere country reports increased acreage and prospects of a record or near-record outturn from the harvest now in progress.

MEDITERRANEAN AREA

Olive oil production. Olive oil production from 1953 crop olives in the Mediterranean basin is expected to be abundant. A preliminary estimate places the output at 1,159,000 short tons, compared with the revised estimate of 801,800 tons of oil from 1952 crop olives and the record high of 1,611,100 tons from the 1951 crop. These production estimates represent the total oil pressed, including allowances made for consumption by growers in countries reporting only commercial production.

The 45% increase in oil production from the previous year is explained by the fact that 1953 was the year of high output in the two-year cycle normally characteristic of olive production and by the fact that weather conditions on the whole were more favourable than in 1952. Spain was an outstanding exception, however, to the generally favourable weather, as drought throughout the summer and early fall greatly reduced the size of the olive crop. Insect damage in general appears to have been less than in 1952, with the possible exceptions of Italy and Greece. Most countries except Greece have reported that the quality of the new oil is uniformly good.

An increased volume of oil production is in prospect in all Mediterranean countries this season except Turkey, Algeria and Israel. The most significant expansion, however, is in Portugal, Greece, Italy and Tunisia, where record or near-record crops have been reported. Normally Spain, Italy, Greece and Portugal account for 80% of the total Mediterranean production.

Spain's oil production is now estimated at 330,000 tons, or 10% more than the outturn from the 1952 crop. The olive harvest, however, was a disappointment because a large crop normally is expected to follow a low outturn and oil from the 1953 olives is less than one-half the output from 1951, the previous year of high production. Nevertheless, this volume of oil, together with a carry-over from last season of at least 100,000 tons, is expected to be sufficient to satisfy Spain's domestic requirements and to provide some 50,000 tons for export and carry-over. Italy's olive oil output may approximate 300,000 tons, representing a 50% increase from last season. However, this tonnage would be almost one-fourth less than the record production of 1951.

Greece expects 173,000 tons of oil, the third largest volume on record. The decrease of roughly 10% from earlier expectations is attributed to heavy and late infestation of the olive fruit by the Dacus fly. As a result, the quality of the oil is generally below average.

Portugal anticipates a record outturn of 150,000 tons of oil, or over two and one-half times the tonnage from the 1952 crop. The problems arising from this year's over supply position will be enhanced by the increased availabilities in most other Mediterranean countries. Total oil obtained from crushings in France is estimated at 12,000 tons, or an increase of 70% from the previous year. Yugoslavia's outturn is believed to be up about one-third. Oil production in the Middle East is down as a result of the sharp drop in Turkey, where output is reported at one-half the previous season's tonnage. Syria and Lebanon appear to have the normal output of a ' good ' year.

North Africa likely has a near-record tonnage of olive oil, resulting largely from Tunisia's excellent output of an estimated 90,000 tons. This volume of production has been approached or exceeded in Tunisia only twice in the past 14 years. Production in Algeria is expected to be slightly less than last season. Output the past three years, however, has been relatively constant. French Morocco reports a large production and a better-than-average outturn is likely in Libya.

(*From ' Foreign Crops and Markets.'*)

UNITED STATES

Fats, oils and oilseeds. Despite lower Government support, prices this year for important oil crops, production of fats and

oils in the United States will probably increase in 1954-55 (the 12-month period beginning next autumn). According to farmers' plans in early March, there will be a 13% increase in soya bean acreage. If the yield per acre returns to average from last year's unusually low level, soya bean production this year is likely to rise by 25% or 30%, reaching the highest level on record, and production of soya bean oil in 1954-55 would rise similarly. This increase in the production of soya bean oil, together with an expected increase in lard production beginning next autumn, would more than offset a probable decline in production of cottonseed oil. The harvest of cotton lint and cottonseed in the United States next autumn is expected to decline as a result of restricted cotton acreage allotments for 1954. Among non-food items, there will be an increase of more than 20% in linseed production this year, if farmers' plans are carried out and the yield per acre is about average. A crop of this size would be the second largest on record and would be substantially larger than needed to provide an ample supply of linseed oil for a year's domestic consumption.

In addition to the prospective increase in production of oils and fats in the United States in 1954-55, large carry-overs of cottonseed and linseed oils will undoubtedly still remain next autumn. This means that the United States is very likely to continue to have heavy exportable supplies, notably of soya beans, liquid edible oils, linseed oil, and inedible tallow and greases. However, a substantial part of the exportable supplies (other than tallow, grease and lard) will continue to be in Government stocks, and the prices and quantities of exports from these stocks will depend on Government policies.

FRANCE

Grain crops. The growth of French grain was influenced by exceptionally dry conditions, together with abnormally low temperatures. Frosts, however, had no influence on grains. The area under grain crops increased by 250,000 hectares owing to the extension of wheat and barley sowings on May 1, 1954; 4,416,000 hectares were under wheat, including 138,000 hectares of spring wheat. This was an increase of 7% over the 1953 area. The condition of the crop was generally good. Spring wheat was slow to germinate.

The area under rye was at last year's level, 416,000 hectares. This halted the downward trend noted in the cultivation of this cereal since the war. Barley sowing, completed at the end of April, showed a further increase of 1,212,500 hectares—177,500 more than on May 1, 1953. This included 876,000 hectares of spring barley, against 822,000 a year ago. Despite unfavourable weather conditions for spring-sown, condition of new sowings was said to be fairly good.

The decrease in the area sown to oats was particularly sharp because last year part of the wheat destroyed by bad weather was replaced by oats. For this reason the area under oats—2,169,200 hectares—was not only lower than a year ago (2,248,000 hectares), but also smaller than in 1952 (2,199,000 hectares). This reflects the gradual decline of consumption in France.

Ground preparation for maize has generally been completed. Though it is still too early to estimate the area under maize, it is believed that there will be an increase in the acreage.

The delay in rice field preparations, recorded in March, was further accentuated in April. Strong winds have affected sowing and it is expected that the acreage will decline still further.

ENGLAND AND WALES

Agricultural conditions. Agricultural conditions in England and Wales on May 1, 1954, have been summarised in a report by the Ministry of Agriculture.

Good progress was made with cultivations and sowing. The growth of corn crops was retarded by cold and dry conditions. Pastures were backward and needed rain.

Rain fell generally in the opening days of April, but afterwards dry and sunny conditions prevailed over England and Wales, amounting to absolute drought over a wide area. Night frosts were unusually frequent and there was an absence of warm days.

Good progress was made with the sowing of corn and in most areas the work is complete. On the whole, satisfactory seed beds were obtained, but in some districts the heavier soils, especially those late ploughed —had not worked well.

Corn crops. Winter wheat was generally satisfactory, although growth had been slow and some crops had lost colour. Damage by wheat bulb fly was reported from several districts. Spring wheat germinated well on the whole, but was rather backward.

In many areas winter barley had recovered from the effects of earlier frosts, but was generally backward. Spring barley had germinated well, apart from some later sowings, but cold weather had checked growth. Winter oats were satisfactory, although slow to make growth. Spring oats looked well, but growth had been slow. Mixed corn and rye were generally satisfactory but backward.

Early sown crops of peas were generally satisfactory, although backward, but later sowings had been slow to germinate. Damage by weevil was reported from some districts.

The planting of potatoes proceeded under favourable conditions in most areas during the month, but on some heavier soils difficulty was experienced in getting a satisfactory tilth. Slight frost damage to early crops was reported from a few districts.

The preparation of land for roots made good progress, except on heavier soils, which proved difficult to work. Fair progress was made with the sowing of sugar beet, fodder beet and mangolds.

Pastures. Leys were generally healthy, but had made little growth. Response to the application of top dressing was slow owing to the lack of rain. Permanent pastures were also retarded by cold and dry conditions and provided less keep than usual.

BURMA

Oilseed production. Production of major oilseeds in Burma in 1953-54, namely, peanuts, sesame and cottonseed, is expected to be around 305,000 short tons or approximately the same as last year. A significant increase in peanut acreage and production was offset by a substantial drop in sesame output, resulting from unfavourable growing conditions.

In 1953 the Government intensified its efforts to increase peanut plantings as a second crop on rice lands in the delta of lower Burma. That programme continued to show good results, as indicated by the gradual increases in planted acreage. The 1953-54 peanut output is estimated at about 210,000 tons from a harvested area of 781,000 acres, against 200,000 tons from 723,000 acres in 1952-53.

Sesame production is estimated near 50,000 tons, against 60,000 tons the previous season. Unusually low and poorly distributed rainfall in central Burma, the major producing district, was primarily responsible for the drastic drop in output. Cottonseed production is believed to be around 45,000 tons, although official estimates of cottonseed output as such are not available.

Vegetable oil imports in 1953 were well below those of the preceding year. Peanut oil receipts were only about 335 tons, as compared with 9,598 tons in 1952. Coconut oil imports were 13,038 tons, against 22,926 tons the year before. Oils continued to be imported under open general licence and sold on the free market. Under the terms of a five-year trade agreement, India continued to be obligated to make available to Burma 8,960 tons of peanut oil yearly. Shipments of peanut and cottonseed cakes from Rangoon in 1953 totalled 62,720 tons, as compared with 28,000 tons in 1952.